APPENDIX

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CONTENTS.

SPECIAL REPORT

OF THE

Board of State Prison Directors,

IN RELATION TO THE

BRANCH STATE PRISON NEAR FOLSOM.

G. H. SPRINGER.........STATE PRINTER.

SACRAMENTO, November 1st, 1875.

His Excellency,
Governor ROMUALDO PACHECO:

The Board of State Prison Directors respectfully present to you the following special report in relation to the Branch State Prison near Folsom, having delayed to do so until this date for reasons therein set forth.

W. IRWIN,
Lieutenant Governor.

DRURY MELONE,
Secretary of State.

REPORT.

By an Act of the Legislature approved March thirtieth, eighteen hundred and seventy-four, the Board of State Prison Directors were charged with the duty and responsibility of erecting a Branch State Prison near Folsom, in Sacramento County.

On the sixth day of April, eighteen hundred and seventy-four, the Board met for the purpose of entering upon the discharge of their duties under the Act, and directed the publication of a notice in the *Sacramento Daily Union* and the *San Francisco Evening Bulletin* newspapers, of which the following is a copy:

BRANCH STATE PRISON AT FOLSOM—NOTICE TO ARCHITECTS.

Under the provisions of "An Act to provide for the erection and maintenance of a Branch State Prison near the Town of Folsom," the Board of State Prison Directors hereby give notice to architects, and others, that on Saturday, May thirtieth, A. D. eighteen hundred and seventy four, at the office of the Governor, in the City of Sacramento, the Board will receive and examine plans and specifications, in detail, for the construction of a Branch State Prison, on the land and at the site conveyed to the State by the Natoma Water and Mining Company, situated near the Town of Folsom, in Sacramento County.

The plans must be upon the basis of accommodating not less than five hundred prisoners at one time.

They must embrace an exterior wall separate from the building, and inclosing five acres of land. The walls of the entire prison structure must be of granite, taken from the quarries at the prison site, and convict labor must be utilized, so far as practicable or advantageous.

A structure suitable for the accommodation of not less than one hundred and fifty convicts, and in harmony with the general plan, must be first erected; and the Board respectfully suggest to those who may compete for the premium for plans and specifications, the consideration of the advisability or economical advantages of erecting iron cells within temporary wooden walls, to be replaced by granite.

A premium of five hundred dollars will be paid for the plans and specifications adopted.

The Board do not feel authorized under the law to expend more than one hundred and fifty thousand dollars for the buildings, during the next two years.

NEWTON BOOTH, Governor,
R. PACHECO, Lieutenant Governor,
DRURY MELONE, Secretary of State,
Board of State Prison Directors.

SACRAMENTO, April 6th, 1874.

An examination of condition of title to the grounds upon which the prison was directed by law to be placed, having shown that exact boundaries were difficult to ascertain from the deed made by the Natoma Mining and Water Company, the Directors caused an accurate survey to be made and marked in the field.

On the thirtieth day of May, eighteen hundred and seventy-four, pursuant to the notice given, the Directors met to open and consider plans and specifications of architects, such having been submitted by William Kirk, Augustus Laver, S. C. Bugbee & Sons, Wright & Sanders, R. C. Ball, and A. A. Cook; and pending such consideration the Board adjourned.

On the thirteenth day of June the plan of R. C. Ball was adopted, and the premium of five hundred dollars declared by law was awarded to him. One month afterward the Board directed the publication in the newspapers already named of the following:

NOTICE TO CONTRACTORS.

Office Board State Prison Directors, Sacramento, California.

Bids for the construction of a Branch State Prison near Folsom will be received by the Board of State Prison Directors, at Sacramento, on or before twelve o'clock M., August seventeenth, eighteen hundred and seventy-four, at which time they will be opened and considered.

The bids must be on blank forms, which will be furnished by the architect, R. C. Ball, at his office, number forty-nine, Merchants' Exchange Building, San Francisco.

Plans and specifications of the work, to be constructed within the present appropriation, are now ready for inspection and consideration at the office of the architect.

Each bidder must make separate and distinct bids for each section of the work, and for the entire work.

The Board will determine, from a consideration of all the bids, what sections of the work can be completed with the appropriation, and will accept only that bid which is the lowest in the aggregate for the work which they determine to have done. The right to reject any or all of the bids is reserved.

The work must be done under the direction of a Superintendent appointed by the Board.

Bonds must be given in double the amount of the work contracted for.

Payments will be made monthly, on estimates of the architect, in warrants payable from the Folsom Branch State Prison Fund; and twenty-five (25) per cent. will be retained by the Board until the completion of any contract is duly and properly certified by the architect.

The Board is desirous of securing the completion of the cell portion of the building for the reception of prisoners within one year.

Each bidder must accompany his bids with a certified check upon a bank in good standing for five thousand dollars, to be forfeited to the State in the event he should fail upon the acceptance of his bid to enter upon contract according to its terms. The check will be returned when the contract is executed.

All bids must be addressed to the "Board of State Prison Directors, Governor's office, Sacramento, California," and should be plainly marked "Prison Bids."

NEWTON BOOTH, Governor,
R. PACHECO, Lieutenant Governor,
DRURY MELONE, Secretary of State,
Board of State Prison Directors.

In accordance with which, on the seventeenth day of August, eighteen hundred and seventy-four, at the hour of twelve o'clock M., bids were opened and read as follows; each bid being duly accompanied by a certified check for five thousand dollars, and being on the printed form provided for the purpose:

BID OF J. M. MONROE AND C. B. WILLIAMS.

To construct Section No. 1 for	$165,000
To construct Section No. 2 for	12,000
To construct Section No. 3 for	37,200
To construct Section No. 4 for	30,000
To construct Section No. 5 for	17,000
To construct Section No. 6 for	234,000
Total	$495,200
And, in the event of all the bids being accepted, to complete the entire work for	$495,000

BID OF JOHN CALVERT.

To construct Section No. 1 for	$148,700
To construct Section No. 2 for	12,000
To construct Section No. 3 for	66,000
To construct Section No. 4 for	65,300
To construct Section No. 5 for	90,000
To construct Section No. 6 for	220,000
Total	$602,000
And, in the event of all the bids being accepted, to complete the entire work for	$601,700

BID OF M. MILES.

To construct Section No. 1 for	$134,395
To construct Section No. 2 for	14,997
To construct Section No. 3 for	44,985
To construct Section No. 4 for	37,767
To construct Section No. 5 for	28,758
To construct Section No. 6 for	182,763
Total	$443,665
And, in the event of all the bids being accepted, to complete the entire work for	$443,630

After mature consideration it was resolved to enter upon the construction of Sections One and Two, for the details of which you are respectfully referred to the specifications, a copy of which accompanies this report; and the contract therefor, of which the following is a copy, was duly awarded to M. Miles:

This agreement, made and entered into this first day of September, A. D. eighteen hundred and seventy-four, between the State of California, by the Board of State Prison Directors, consisting of Newton Booth, Governor, R. Pacheco, Lieutenant Governor, and Drury Melone, Secretary of State, party of the first part, and M. Miles, contractor, of the City and County of San Francisco, party of the second part, witnesseth: the party of the second part, for and in consideration of the payments hereinafter mentioned to be made, for himself, his heirs, executors, administrators, and assigns, does hereby covenant, promise, and agree, to and with the State of California, the said State Board of Prison Directors, and their successors in office, on or before the fifteenth day of November, A. D. eighteen hundred and seventy-five, to erect and complete that portion of the building of the Branch State Prison at Folsom as shown and designated on the plans and drawings of R. C. Ball, architect of the said prison, by line II, and described in the plans and specifications as Section No. One (1). Also, to erect and complete that certain other portion of said Branch State Prison building shown and designated on said plans and drawings by lines II and EE, and described in the plans and specifications as Section No. Two (2). Said buildings to be erected and completed on or before said fifteenth day of November, A. D. eighteen hundred and seventy-five, in a good, skillful, and workmanlike manner, and in all respects in conformity with the plans and specifications, and the bid of said party of the second part, and their true intent and meaning, and to the satisfaction and under the control and direction of the said State Board of Prison Directors, their successors in office, and their architect. The party of the first part, in consideration of the covenants and agreements herein contained and the faithful performance of this contract, hereby covenants, promises, and agrees well and truly to pay or cause to be paid to the party of the second part, his heirs, executors, administrators, or assigns, the sum of one hundred and forty nine thousand three hundred and ninety-two dollars, in warrants of the State of California, drawn on the Folsom Branch State Prison Fund in manner following—that is to say: in the amount of eighty (80) per cent of the whole amount due as shown by the bill of quantities to be furnished, as set forth in the bid, payable on the first day of each and every month until the contract is completed; the estimate to be made by the architect and to the satisfaction of the State Board of Prison Directors; the remaining twenty (20) per cent to be paid upon the final completion of the work to the satisfaction of the State Board of Prison Directors and their architect.

Item: The plans and specifications mentioned in this contract are those drawn and furnished by R. C. Ball, architect, and adopted by the Board of State Prison Directors, and are hereby made a part of this contract.

Item: The bid mentioned in this contract is the bid of the party of the second part, made by him and accepted by the Board of State Prison Directors on the seventeenth day of August, A. D. eighteen hundred and seventy-four, a copy of which, together with a copy of the said specifications, are hereto annexed and made a part hereof.

In witness whereof, the parties have hereunto set their hands and seals, this first day of September, A. D. eighteen hundred and seventy-four.

NEWTON BOOTH, Governor.
——— ———, Lieutenant Governor.
DRURY MELONE, Secretary of State.
MICHAEL MILES.

Under this contract work was commenced on the building in November, eighteen hundred and seventy-four, William Johnston having been appointed Superintendent.

From an examination of the plans, specifications, and contract, it will appear that the Board, following strictly the intention of the law, and guided in their conclusions by the appropriation of one hundred and seventy-five thousand dollars, made for the purpose, had thus insured the construction of so much of the entire prison, adhering accurately to its general plan, as would securely accommodate at least one hundred and fifty prisoners, and would thus permit the use of convict labor upon the work remaining to be done. If the contractor had fulfilled his obligations, the Branch Prison would now be in successful operation, and would sensibly relieve the Resident Director at San Quentin of evils which result from overcrowding. But the contract has not been fulfilled, and we have to report that no work has been done under it since the tenth day of September, eighteen hundred and seventy-five. On the fifteenth day of that month the Board held a meeting at the unfinished building, the proceedings at which are recorded fully in their minutes thereof. The contractor having claimed, and put forth as a reason for neglecting to comply with the conditions of his contract, that he did not consider himself under contract to furnish or put in place the water and other pipes connecting cells and sewer, nor the cell doors and locks, and that it was necessary for the Board to pass upon the question, as the cost involved was something more than twelve thousand dollars, the Board made a thorough examination of the point, and as the result, determined and decided that the contract, plans, and specifications require the contractor to complete the cells included in his contract, including the ironwork connecting with the sewer, and

including the cell doors and locks, so that when the cells are completed they will be ready for the safekeeping of the prisoners. On the twenty-fourth of the same month, the Board met and unanimously ordered and directed "that Michael Miles, the contractor to build the Branch State Prison, near Folsom, be notified that the Board of State Prison Directors require and demand that the building and construction of the said Branch Prison be prosecuted diligently and completed in accordance with the terms of the contract; and that for any failure to so prosecute the work and complete the contract, the contractor and his bondsmen will be held responsible upon his bond." A copy of such notice was also mailed to each of the bondsmen. At the date of this report, it is evident, even if work be resumed, that the contract cannot be completed within the specified time. In view of the fact that the Board, as now constituted, will not be called upon to assist in the final solution of the difficulty which has arisen in relation to the work, and assured that all possible information at their command is embodied in this report and in the book of minutes of their various meetings, it is not deemed proper to offer further comment upon the subject, than to say that, so far as the State is concerned, her agents in the premises have caused her obligations to be amply and promptly met.

The following expenditures have been made out of the one hundred and seventy-five thousand dollars appropriated:

Nov. 1, 1875..	Amount paid Architect to date..................	$4,900 00
	Amount paid Superintendent to date.........	2,600 00
	Amount paid miscellaneous to date...........	1,959 23
	Amount paid M. Miles on contract...........	71,008 66
	Amount paid M. Miles on extra work........	8,114 47
	Total expenditures..............................	$88,582 36

Statement showing expenditures and liabilities on the contract with M. Miles, to November first, eighteen hundred and seventy-five.

	80 per cent paid.	20 per cent due.
December 7th, 1874..............................	$9,723 68	$2,430 92
February 1st, 1875..............................	6,047 50	1,511 87
March 15th, 1875..............................	6,121 88	1,530 47
April 3d, 1875..............................	8,221 84	2,055 46
May 3d, 1875..............................	10,949 78	2,737 44
June 5th, 1875..............................	7,780 66	1,945 17
July 8th, 1875..............................	8,019 72	2,004 93
August 2d, 1875..............................	6,717 54	1,679 39
September 6th, 1875..............................	6,775 02	1,695 00
October 27th, 1875..............................	651 04	162 76
Totals..............................	$71,008 66	$17,753 41

In excavating for the foundations of the building it was found advisable, for greater security, to go deeper than the Architect, guided by surface appearances, had originally planned; and the size and depth of foundation wall being thus increased, the Directors allowed and paid the contractor accordingly. In this connection the Board desire to say that no other extra work has been done.

The following statement shows what has been allowed, what paid, and what remains due:

Statement showing payments and liabilities for extra work done by M. Miles, to November first, eighteen hundred and seventy-five.

	80 per cent paid.	20 per cent due.
February 1st, 1875..............................	$4,403 00	$1,100 75
March 15th, 1875..............................	1,665 49	416 37
April 3d, 1875..............................	427 96	106 99
May 3d, 1875..............................	201 60	50 40
June 5th, 1875..............................	1,416 42	354 11
Totals..............................	$8,114 47	$2,028 62

Annexed is a copy of the plans and specifications:

BRANCH PRISON AT FOLSOM.

Estimates to be made on the sections and so described in letter.

Contractors will observe the lines on elevations and sections which will designate the different portions of the work hereinafter explained in the following paragraphs:

Section No. 1 comprises the excavations, the air ducts under the building, the sewers under the building, and the completion of the cells one story high, also, the building of the cell-house up to the window sills, also, the building of the front portion of the building up to the top of the first story joist, as shown on line D D, but will not include any of the inside finish or the stairs or balconies in the cell-house, nor the building of the tunnel stairway to the cell-house.

Section No. 2 will comprise that portion of the building, as shown on plans, from line D D to line E E, which is the second story of the front buildings without the inside finish and plastering and the stairs and balconies and other work in said section.

Section No. 3 comprises the building the front building, including the building of the tower walls, including the roofing of the front building.

Section No. 4 comprises the putting in of all the finish; the lathing and plastering; the iron grating in the openings between the cell-house and main building, also, the windows and doors, plumbing and finish throughout the buildings.

Section No. 5 comprises the completion of the air ducts, the sewers, the tunnel stairway from the work yard up to the cell-house, also, the completion of the porches and steps thereto.

Section No. 6 comprises the completion of the cell-house with all the appurtenances.

Contractors estimating on the different sections will please observe the lines as shown on plans and sections to avoid mistake.

SPECIFICATIONS

Of Branch State Prison, at Folsom, Sacramento County, California.

For the several artificer's work to be performed in the erection and entire completion of the whole, or such a portion of the Branch State Prison, as the Directors may direct to be built on the land and at the site conveyed to the State by the Natoma Water and Mining Company, situated near the Town of Folsom, in Sacramento County, California, with the appurtenances conformably with the plans and drawings thereof. Specifications and working drawings for the same made and provided by R. C. Ball, Architect, 49 Merchants' Exchange, San Francisco, California, under whose superintendence the whole is to be performed as directed.

WHAT THE CONTRACT INCLUDES.

The contract includes the completion and erection of the front building, to be used for the prison officers, dining room, guard-rooms, hospital, chapel, dispensary, etc., etc.; and the putting down the main sewer, the air ducts, and the building of the cell-house up to the window sill; also, the building the cells one story high and making complete for the reception of the convicts; and, also, the completion of the arched tunneled staircase, from the cell-house to the work-yard, and the erection of the gateway, etc., etc., and works as shown and implied in the specifications, sections, plans, detailed and working drawings, which are important and proper for the perfect completion of the works, according to the true intent and meaning of the contract, as directed by the architect.

DRAWINGS AND SPECIFICATIONS.

Enlarged and detailed drawings, and the measurements and figures thereon, are to be adhered to, in preference to those of a more general nature. Said detailed drawings may be furnished at the commencement of the works, or at any time during their progress; all of which will be considered as a part of this contract, and strictly adhered to and carried out as directed by the architect.

The contractor will see that the works are set out (by the foreman of construction), who will be held responsible for their correctness; nor will any excuse as to the orders of the architect or clerk of works be admitted as a justification of any errors of construction or departure from the true meaning and terms of this contract.

TOOLS AND TACKLES.

The contractor will erect temporary sheds and buildings for the storage of machinery and tools; also, for materials, lime, cement, and other

perishable things, and provide all materials, labor, tools, tackles, derricks, cartage, scaffolding, centers, turning pieces, shooks, to carry off the water and debris, and all implements of every description and kind.

FOREMAN.

A competent foreman shall be kept at the works, during their progress, to receive and transmit the orders from the architect, in the absence of the contractor, who shall be his legal representative, and shall have full power to make alterations or deviations in the works that in the judgment of the architect are not in accordance with the contract. Should the foreman so appointed be considered by the architect incompetent, or conduct himself improperly, he shall be removed and another appointed in his stead.

SUPERINTENDENT.

The superintendent will be the legal representative of the architect, in his absence, and will have full power to temporarily suspend the works where there is a reasonable doubt that the workmanship and materials are not in accordance with the true intent and meaning of the plans and specification; and in case it is found necessary to stop the work for such reasons, the clerk will immediately notify the architect, and will await a written instruction from him how to proceed.

PROGRESS OF THE WORKS.

The works must be executed in the most substantial and workmanlike manner, with proper and appropriate materials, under the directions and general supervision of the architect, and he shall have the power and authority to decide all questions arising under the contract, as to the meaning of the plans and specifications, work, or materials; and his decision shall be binding on all parties, and be final and conclusive.

The contractor must take special notice, that every circumstance appertaining to the well-being of the structures will be most strictly insisted upon, and that no allowance or indulgence will be made for any breach of this contract; but on the other hand, the most rigid rules will be enforced to complete the building and works in accordance with the full intent and spirit of the specifications.

In case any part of the works shall be erected in a slight or unsound manner, the same shall immediately be pulled down and rebuilt at the expense of the contractor; or should any part of the works be erected not in accordance with the plans and specifications herein contained, the works will immediately be altered to conform with the plans, specifications, and detailed drawings, and with the written instructions given by the architect.

Should the Board of Directors, at any time during the progress of the buildings and structures, require any alterations, deviations, or omissions from the said contract, plans or specifications, they may make such changes, and the same shall in no way affect or make void the contract, but the cost thereof shall be added to or deducted from the amount of the contract, as the case may be, by a fair and reasonable valuation.

Should any dispute arise respecting the true value of the extra works, or the works omitted, the same should be valued by two competent per-

sons, one appointed by the Directors, and the other by the contractor, and in case they cannot agree, these two shall have power to name an umpire, whose decision shall be binding on all parties, and shall be final and conclusive.

Should the works not be carried on with proper dispatch to afford, in the opinion of the Directors, a reasonable probability of their being completed within the time stipulated in the contract, the Directors, by giving fifteen days notice, may enter on the works, and employ such labor and materials, either by contract or otherwise, as they may deem proper, for the completion of the works; the expenses thereby incurred shall be paid out of any money due the contractor, and any differences shall be borne by his sureties. Should the architect at any time deem it proper to suspend the works, for any cause whatever, he shall have the power to do so, and no damage shall be paid to the contractor on that account, but a reasonable extension of time shall be allowed for the completion of the works.

DAMAGE BY ACCIDENTS.

The entire risk of damage of whatsoever nature will be borne by the contractor (earthquakes and fire excepted), excepting so much of the building and works as may be actually completed and received by the architect.

PROPOSALS.

No proposal will be received unless made unreservedly in compliance with the plans, and specifications and stipulations generally. The acceptance of any bid by the Directors, is understood to be an engagement on the part of the parties making it, to contract and undertake the work, and requires the due performance of everything heretofore stipulated. The contractor will nevertheless be required to enter into a more formal contract, under a bond for himself, to be approved by the Directors, with at least two sufficient sureties in double the amount of his bid. No bidder will be allowed to deposit more than one tender for the work, and if more than one from the same person should appear, all his bids will be rejected.

TIME FOR COMMENCING AND COMPLETING THE WORK.

The contractor must commence the work within —— days from the signing of the contract, and carry it on with all possible diligence and dispatch to its completion. The work to be handed over to the Directors and delivered to them fully completed, to the satisfaction of the Architect, on or before the time stipulated in the contract, under a penalty of —— dollars per week for every week the work remains unfinished beyond the above stipulated time. The above forfeitures to be deducted as liquidated damages, from the amount of the contract, if due and if found to be insufficient, to be borne by the contractor's sureties. If the contractor fails to comply with any of the foregoing terms and conditions, or fails to complete the works in accordance with the plans specifications, and instructions given him from time to time by the Architect, during the progress of the works, the Directors have the power to terminate this contract. Separate estimates will be required for the completion of each section of the works, as described by section line on the plans and section, numbering respectively, 1, 2, 3, 4, and 5.

EXCAVATIONS AND EMBANKMENTS.

Fill in the entire area of the work-yard, as shown on plans and sections, to make a uniform grade from the main front gateway at the tunneled stairway (which will be eighteen feet above high tide, as established by Wm. J. Lewis, Civil Engineer), and descending fifteen feet to the front wall, near the American River. Also, excavate for a large brick sewer, to be constructed in the form and shape of an egg, point down. Said sewer to be two feet eight inches (2 ft. 8 in.) wide, by four feet six inches (4 ft. 6 in.) high, inside measurements; said sewer to run from the ravine on the grounds and extend through the wall on the bank of the American River, and to have a grade of not less than one foot to every fifteen; also, excavate for the branch up to and under the main cell house, connecting with the cement or iron stone sewerage pipe from the cells; grade off for the air-ducts, and refill all around all sewers and air-ducts, and tamp solid; also, cut away for the tunneled stairway, or main entrance to the cell house, and level the entire site of the building for the foundations of prison offices and cell house, conformable with the plans and sections, and to the grade stakes given by the engineer on works. All the surplus earth to be removed and placed where required, to fill in about the yards and walls of the building, and tamped solid, as directed; also, deposit on the yard the spauls from the quarry, until the whole is made of a uniform grade, as shown on sections. All the boulders of the quarry that may be found on the site, will be worked up, to be used in the foundation walls. Quarry out the granite that comes in contact with the main prison walls, and work it up to the best advantage, to be used in the walls and cells; care being taken to get it out in pieces of proper lengths and widths to make floors, and walls to cells. The contractor will nevertheless be required to take all the granite used in and about the place from that portion of the quarry which is embraced inside of the work-yard, at the same time depositing the debris on the most depressed portions of the work-yard and premises; unless it may be found that the dimension stone can be got out elsewhere with much less expense than that within the inclosure or contemplated work-yard.

DRAINS AND SEWERS.

The drains and sewers, to be formed as shown on the plans of the several descriptions marked thereon, all to be the best quality of Martin's cement or iron stone sewerage pipe, laid as directed, and put down with the best quality of hydraulic cement; also, put down two air-ducts from the main front wall, of proper size, to the ventilating flues for the cells, and connect the branch sewers with the galvanized iron soil pipes from the water-closets.

BRICK SEWERS.

The main sewer will start from a point (shown on the plans), in or near the ravine, and run across the work-yard and out through the walls on the American River, a distance of about four hundred and ten (410) feet, the dimensions to be two feet eight inches (2 ft. 8 in.) wide, by four feet six inches (4 ft. 6 in.) high; also, a branch, which will be two (2) feet wide, by three feet four inches (3 ft. 4 in.) high, inside measurements, running from the branches of the main cell house to the

main sewer, all to be well trapped before it enters the main. The wall to be eight inches (8 in.) thick all around, built with the best quality of black and hard burned bricks, to be found in the vicinity, well bedded and laid up in hydraulic cement mortar; put in (to produce a proper current) with a fall of at least one (1 ft.) foot to every fifteen (15) feet. All connections to be made with Portland cement, and none will be allowed to be used in the works after being mixed more than one hour.

GRANITE.

The principal material used in the construction will be granite, taken from the quarry on the site of the work-yard and adjoining grounds. None but the best stone, of uniform color, free from seams and blotches, or stains from oxydation, will be allowed to go into the works. Great care must be exercised to exclude any stone liable to become discolored from exposure to the weather.

CONCRETE BED.

There will be a concrete foundation under all the footings for the front yard wall, also, under all walls where there is moisture in the ground, and where directed by the Architect—all as shown on plans and sections. The concrete to be composed of one and one half ($1\frac{1}{2}$) barrels of slacked lime in powder, to one and one half ($1\frac{1}{2}$) barrels of Benicia or Rosendale cement, eleven (11) barrels of gravel, thirteen (13) barrels of concrete stone, egg size, and seven (7) barrels of sand, all accurately measured in a box prepared for that purpose, and mixed together without water, by manual labor. A sufficiency of water to be added. the materials to be thoroughly worked and mixed together by manual labor, and to be thrown into the trenches, to be immediately rammed and beaten down by men constantly employed in the trenches to level, combine, and cement the whole together. All concrete beds will be put down in layers not more than eight inches (8) thick, and well rammed and leveled, each layer, and the base to project not less than one and one half ($1\frac{1}{2}$) feet on each side of the stone footings to the walls, and to be not less than four feet (4) deep, all the trenches to be dug out and made level on the base before the concrete is put in. The entire area under the corridors will have one eighth inch layers of concrete; also, under the prisoners' dining room and kitchen, the laundry and convalescents' dining room, and store room; also, under front and side porches.

STONE FOUNDATION.

The foundation for all the walls will be built of the best quality of granite, to be taken from the quarry on the site. The footings will be laid with flat bedded stone, laid on their natural beds, in irregular courses, and every second stone to pass through the whole thickness of the walls as they rise, and of the different thicknesses, as shown and figured on the plans and sections. The above walls to be laid up in mortar. (See mortar specifications.)

SUPERSTRUCTURE.

Walls above the foundation will be built of the best quality of granite, laid up in broken ashler, with horizontal and vertical joints, the building and setting bed to be rough point hammered and leveled off in courses, every eighteenth and one fourth inches ($18\frac{1}{4}$) in height, in line with the quoins at angles, corners, and openings. None but the best stone of uniform color, free from seams, blotches, and mineral stains, or oxydation, will be used in the walls; laid on their natural beds; well bedded in mortar, and properly hammered down and bedded. The interior to be well filled with mortar and chips. The headers will extend through the whole thickness of the walls every third course as they rise. The walls are all to be carried up regularly, and no one part built more than the height of one scaffold above the other during its execution. All the internal and external joints will be clean and neatly drawn with a trowel, and will not exceed one half inch ($\frac{1}{2}$ in.) in thickness. No stone will be used in the walls less than four inches (4 in.) thick, in the face of the walls, and must extend into the walls not less than eight inches (8 in.) The courses will be laid up with one header to every two stretchers. The heading stones will not be less in length on the face, than twice the height of the courses, of which they form a part; nor less in depth of top bed than double the height of said courses. No stretcher will be less in length than twice the height wherein they are to be inserted; nor less in depth at the top than the height. The bond in the vertical joints is not to be less than the height of the course immediately below them.

BASE COURSES.

The base courses at the level with the first floor, will have a neat peine hammer weathering with one and one half inch margin draft on upper and lower edge, and pointed off in the center to give a bold rock face; the beds will be eight inches (8 in.) and fourteen inches (14 in.) alternately, with the margin draft at each corner and angles; the under side will be neatly tooled and throated, as shown on drawings; all corners to be wrought on the solid, as directed.

QUOINS.

The corners, where rectangular, will have two feet eight inches (2 ft. 8 in.) face for the long quoins, and the short will be two feet one inch (2 ft. 1 in.) long and eighteen inches (18 in.) high, with one and one half inch ($1\frac{1}{2}$ in.) margin draft. The long quoins will have not less than fourteen inch (14 in.) beds, and the short, not less than nine inch (9 in.) beds. The margin draft to project from the face of the building one and one half inch ($1\frac{1}{2}$ in.); the center to be neatly pointed off and left with a bold rock face. The quoins on the octagon corners will be two feet one inch (2 ft. 1 in.) long, and the short ones will be one foot and eight inches (1 ft. 8 in.) long, with margin drafts as above. Each quoin and return will be made solid, and to be made to line with the trimmings on openings. Great care must be taken to preserve the outer arrisses, so that when the work is set, the joint will be close and solid throughout.

DOORS AND WINDOW SILLS.

The door and window sills are all to be neatly weathered on top and throated under side, all neatly peine hammer dressed, and to project not less than three inches from the face of the wall, with one and one half inch

(1½ in.) margin draft, and the center neatly pointed to give a bold rock face. All of said sills to go through the whole thickness of the wall in the cell house, and the front part of the building, to a depth as shown on detailed drawings, and as directed by the Architect.

HEADS AND JAMBS FOR DOORS AND WINDOWS.

The window and door heads and jambs will be carried up with in and out tie (or inband and outband) nine and one eighth inches (9⅛ in.) i height; the inbands will be the whole thickness of the walls, and to be fourteen inches on the heads; the outband to be nineteen inches on the head and seventeen inches on the beds. The building and setting bed will be peine hammered, and the joints to be not more than one fourth of an inch (¼ in.) and to be full and square the whole depth, and grea care must be taken to preserve the outer arrisses, so that when finished the joints will be close and solid throughout. The faces will have on and one half inch (1½ in.) margin draft, and pointed off, and left with bold rock face. The reveals and chamfers will be neatly peine ham mer dressed, and rebated to receive the frames as shown on detaile drawing. The front mullin window frame will be fine bush hamme dressed in the spandrel head, as shown on elevations and detaile drawings.

FIREPLACES AND FLUES

Will be carried up with the top, agreeable to the detailed drawing and put in two and one half inch (2½ in.) by one half inch (½ in.) cham bered arch bar, one foot six inches (1 ft. 6 in.) longer than the clea width of the opening. Line up the flues with brick eight inches b eight inches (8 in. x 8 in.) in diameter, and turn a nine inch brick trim mer arch over each fireplace; and form flues for fireplaces, and buil in thimbles where shown on plans and where directed. Turn trimme arches four inches deep and back one foot and ten inches (1 ft. 10 in.) fro the breast of the chimneys to receive the hearths throughout the entir building; all of said arches to be left until the mantels are ready to b set, to prevent shrinkage and settling.

CORNICE ON OFFICERS' QUARTERS.

The coping stone will be made as per detailed drawings; to be n less than one foot and six inches (1 ft. 6 in.) on the wall, and to proje over the face of the frieze not less than one foot and eight inches; t upper section will have a one and one half inch (1½ in.) margin dra with weathering and gutter formed in the stone on the solid, and t face of the upper section neatly pointed off. The two lower portions the cornice will be moulded and neatly peine hammer dressed; the joi will be neatly cut to break over the brackets, and none made more th one fourth of an inch (¼ in.) thick; the frieze will have a two inch m gin draft all around, and the center neatly pointed off to leave a b rock face; the building and setting beds to be level and to exte through the whole thickness of the wall. The brackets will be neat peine hammer dressed, and set in the wall not less than eight inc (8 in.), with level building and setting beds; said brackets to be se inches (7 in.) on the face. No corners or angles will be mitred, but w be wrought on the solid; all the joints in the entire cut work will raked out to a depth of one half inch (½ in.) and neatly pointed w

cement mixed with lampblack and boiled linseed oil, all to be made according to the plans and sections, and as directed by the Architect.

CELL WALLS.

The cells will be built the sizes as shown on the plans and sections; the floors for the cells must be made of stone, of the proper lengths, to extend the whole width of the cell, with not less than four inch bearings on each end, and not less than twenty inches wide and dressed with joint not more than one fourth of an inch (¼ in.) thick. Said floors will be twelve inches (12 in.) thick, all neatly point hammer dressed, with horizontal building and setting beds; each stone will go through the whole thickness of the wall, except the center partition running longitudinally with the cell house, will be one foot ten inches thick, which will be got out in two thicknesses, back to back, as shown on sections, all to be clamped together with wrought iron clamps, three eighths of an inch thick by one inch wide; each stone will be clamped in not less than four places, with not less than two one half inch (½ in.) round iron dowells, three inches long, let in and set in good hydraulic cement. The front, or outer walls, will be got out with stone running from wall to wall, and from door to door, in courses one foot six inches high, with sixteen inch building and setting beds, and the joint neatly peine hammer dressed and set with two dowells to each stone (as above). The jambs of the doors will be neatly peine hammer dressed. The outside will be laid in regular ashler with one and one half inch margin draft, with the drafts cut into the stone, as shown on detailed and elevation drawings. The center to be neatly pointed off, leaving a bold rock face, free from tool marks. Each stone will have two dowells made of one half inch (½ in.) round iron, three (3) inches long. The transverse walls will be made one foot and two inches (1 ft. 2 in.) thick, with the stones running from wall to wall at any height above twelve inches (12 in.). Each stone to have two clamps; all of the inside of the cells will be neatly point hammer dressed. Cut the outlet to the ventilating shaft with one inch (1 in.) margin draft with chamfered jambs, all to be neatly peine hammered. All joints will be neatly peine hammer dressed, and will not be more than one fourth of an inch (¼ in.) thick. The entire work in the cells will be laid up with Portland cement mortar; the joints will be neatly drawn with the edge of the trowel. Particular care must be taken to preserve the outer arrisses, so that when the work is set the joint will be close and solid throughout. Transverse walls to be double, with beds not less than four inches, backs with quarry face stones, not less than four feet long, grouted between. Front wall to break joint every other course, in middle between doors. Longitudinal walls to have quarry backs; beds not less than eight inches; stones not less than three feet long, grouted between.

STONE FLOORS.

The floors of the cell house will be flagged, over the entire area, on top of the concrete bed, with pieces of granite not less than eight inches (8 in.) wide, sixteen long, and eight inches (8 in.) thick; the joints neatly straightened and set in Portland cement; the tops to be neatly point hammer dressed, and a gutter formed next to the outer wall of the cell house, to drain off the water when the floors are washed down; also, floor over the vestibule, the halls, the prisoners' dining

room, the laundry, the kitchen and store room for the prisoners, and under the porches outside of the building. All the joints will be raked out to a depth of one half of an inch (½ in.) and filled with cement, lampblack, and boiled linseed oil, and neatly struck with the edge of the trowel.

TUNNELED STAIRWAY.

The arched way to the main work-yard, from the cell house, will be built up with stone jambs two feet (2 ft.) thick, and arched over with stone work wrought out to form a key, and make a complete arch, as shown on plans and sections. The wall will be laid up in irregular or broken ashler, with level building and setting beds, and no stone to have less bed than its height. The gateway will be broken ashler, as above, leveled up every eighteen inches as it rises with the walls; all to be as shown on plans and sections. The quoins will be eighteen inches in height, to line with the courses of the walls, and will not be less than two feet (2 ft.) on the head for the long one, and seventeen inches for the short. The long quoins will bed on the wall not less than twelve inches (12 in.) and the short ones nine inches (9 in.). Said quoins will have one and one half inch margin drafts, and the center neatly pointed off to make a bold rock face.

STONE STEPS.

The entire steps, from the main cell house to the work-yard, will be neatly point hammer dressed and the joints made not more than one fourth of an inch (¼) thick. Great care will be taken to preserve the arrisses so that when the stone is set the joint will be close and solid throughout. The flagstones will be neatly point hammer dressed and laid down eight inches thick on a concrete bed, as shown on plans and sections. The steps will not be in more than three pieces in length and no more than every alternate stone will be in more than two pieces. The steps to the porches will be made of granite, with neatly point top and peine hammered fronts, as shown on plans and sections, the whol to be made to conform with the detailed and scale drawings, and a directed. The joints will be raked out to a depth of one half an incl (½ in.) and pointed with cement, lampblack, and boiled linseed oil, a to be drawn with an approved jointer.

IRON WORK, GRATING, DOORS, AHD BALCONIES.

The windows in cell house will have a wrought iron grating, as show on plans and sections. The horizontal bars will be one half inch (½ in by two and one half inches (2½ in.) wide, run into the stone work fou inches (4 in.) on each side of the jambs. The vertical bars will b square three quarters of an inch (¾ in.) in diameter, running down in the sill and head not less than one and one half inch (1½ in.) and swege in with sheet lead. The opening, where shown on the plans, will hav stationary iron bars the same as those in the cell house window ope ings. There will be two pair of iron grating doors between the ma cell house and the vestibule of the officers' quarters, made in semic cular form, with wicket in the right hand door looking from the cent out, two feet (2 ft.) wide by three feet (3 ft.) high, hung by good, stro wrought iron hinges, as shown on detailed drawings; also provide go strong hasps with staple for padlock. There will be a semicircular formed grating, made stationary, in the third story looking out from the tower, as per plans and detailed drawings. There will be two single doors to the chapel and hospital part of the building, in the third story of the main building, leading to the balconies of the cells, all to be hung with good, strong hinges, and to be made similar to those in the cells with locks the same, all as shown on plans and drawings.

STAIRWAYS.

There will be two flights of stairs, from the main cell house to the dining rooms, laundry, tunnel stairway and guard dining room, with three wrought iron horses made of one half inch (½ in.) by two inch (2 in.) iron, with cast iron tread plates, and perforated risers, all secured to the horses with screws; each tread to have a baluster, as shown on sections, of three quarters of an inch (¾ in.) square iron secured to a one and one half inch (1½ in.) round rail made of galvanized wrought iron piping, by means of screws cut on top end of balusters and screwed into the rail. The front string of the main staircase leading from the main floor to the third floor of the building, will have a fancy fretwork made of one fourth by one and one half inch (1½ in.) wrought iron riveted together, as shown on plans; the lower bar to be one and one half inch (1½ in.) wide; also, the two parallel bars will be three eighths by one and one half inch (⅜x1½ in.), as directed and as shown on sections. The front string of the stairs in the tower will be made of one half by one and one half inch (½x1½ in.) wrought iron with half inch round iron balusters, one on each tread run through the tread and screwed down into the front string, and screwed at top to the one and one fourth inch round rail made of galvanized wrought iron piping. The treads will be one and one half inch Mendocino pine, with neat nosing worked on edge, all to be good, clear, and dry pine, free from defects, with the grain running through the plank (see detailed drawings). There will be cast iron newels to the different flights of stairs, where shown on the plans, and as per detailed drawings.

WROUGHT IRON GIRDERS

Will be made and placed around the well holes, from the cell house to the basement of front building, as shown on detailed drawings. Wrought iron stirrups will be made and placed on all stair trimmers to support the headers; also, at all chimney trimmers, to support the headers. The girders running across the main entrance hall will be rested on wrought iron stirrups made of one half by two and one half inch (½x2½ in.) wrought iron, and bolted to the trimmers and headers. The stirrup to the stairs will be one half by two and one half inch (½x2½ in.) wrought iron, as above; those for the chimneys will be one half by two inch (½x2 in.) wrought iron, all well bolted to the trimmers as directed.

MORTAR.

The mortar used in the prison walls and walls of main building, to be composed of the best quality of fresh burnt Cave Valley lime, mixed with sharp sand in proportions of one of lime to three of sand well incorporated together, and mixed with one of cement to two of lime, immediately before it is used in the works. No cement will be allowed

to go into the works after it is mixed more than one hour. It is distinctly understood that the Architect reserves the right to himself, in the interest of good workmanship, and in this important compound, in particular, to change the proportions at his discretion. All the cement to first be mixed with the sand perfectly dry, and to be of equal quantities of cement and sand, the proportions to be accurately measured and a sufficient quantity of water added and thoroughly incorporated together and mixed with the mortar, as before described, the whole to be well tempered by manual labor so as to effectually combine every particle of lime mortar, in equal proportions with the cement mortar. The walls for the cells and the floors will be set in the best quality of cement mortar compound of equal proportions of Portland cement and sharp sand. The cement used in the walls of the building will be either Rosendale or Benicia cement, as the Architect may direct. All iron clamps will be set in the stonework with brimstone and resin, as may be directed.

ARCHES.

The arches, both external and internal, over all doors, gates, and window openings in the walls, are to be turned on proper centers, the whole thickness of the walls, and all gauged and set in Portland cement mortar; the joints are to be struck, and the external and internal joints pointed. The centers are to be struck with solid skewbacks, cut and formed to receive the arches; all arch stone to be cut to run through the walls as directed, and as per detailed drawing.

PLUMBING.

The plumbing in the cells will be run as shown on the plans and sections, and as directed. The soil pipes for the cells will be cast iron, one fourth of an inch thick, put in in joints, the height of each story, and cast on a taper, starting at the first floor with a pipe five inches (5 in.) inside, and diminishing one half of an inch in diameter in the height of each story. Said pipes to be neatly connected with the sewers with Portland cement. From the soil pipe in the third story of the cell there will be a two inch (2 in.) cast iron escape pipe run up in the angle of the cells and connect, and run over to the ventilator with a two inch (2 in.) No. 20 galvanized iron pipe, to take off the fumes from the soil below. The bowls will be made of cast iron one fourth inch (¼ in. thick, with trap and pan connected, also a hinged cover, which when opened will operate the pan; all of said bowls to be clamped to the soil pipe, as shown in plans and details, and as directed. The inside of the cast iron bowl will be enameled with white earthern ware. The water closets in the front building will be the same as those in the cells, with sugar pine seats and risers. The seats will be one and one fourth inch (1¼ in.) thick, with one inch flaps and risers, to be hung with brass butts two inches wide. There will be a two and one half pound sheet lead pan safe put under each closet with a one and one half inch (1½ in. overflow pipe put in with an approved trap and run down to the sewer and connected with cement. Said pipes to be C lead. The urinals will be of cast iron, with white enameled linings, and to have a two inch galvanized wrought iron waste pipe run down to and connect with the sewer. The wash basins will be white earthen ware, with Italian marble slabs counter sunk, and to be one and one half inch thick, with neat molded edge. The backs will be one inch thick, and eight inches

high, with molded edge, made to suit the lines of the walls, without joints. The service pipes will be made of galvanized wrought iron, three fourth inch (¾ in.) in diameter, run to all water closets, wash basins, and urinals. The water closets in the cells will have plain brass basin cocks; those in the front building will be silver plated compression cock, to be approved by the Architect; those for the urinals will be three quarter inch (¾ in.) brass cock, all to be put in as shown on the plans, and as directed by the Architect. The waste pipes for the wash basins will be C lead one and one half inch in diameter, with an approved trap. All wash basins will have a two and one half pound (2½) sheet lead pan safe, and a one and one fourth C lead overflow pipe, properly trapped and run down to and connect with the sewer. There will be a one and one half inch hose bib put in each of the three corridors in the center of the cell house, to be used in case of fire and for washing up the floors, all to be set and made as directed by the Architect.

GAS PIPING

Will be laid in the several apartments, where marked on the plans, with the number of burners at each point, as will be shown in figures on the plans; all of said pipes to be run with black iron gas tubing and to be graded from the burners, and with tubing of proper sizes to conform with the San Francisco Gas Company's schedule. No pipes will be cut down into the timber to weaken them, but will be run lengthwise with them, unless absolutely necessary, when they may be cut into the timbers not more than six inches (6) one side from the bearing below. The pipes, where run on the sides of the cell house and other places on the stone walls, will be built into the walls, and particular care must be exercised to keep from breaking the joints. The meter will be placed in the building where directed by the architect.

TIMBERS.

The timber for the frame of the buildings will be the best quality of Puget Sound pine, free from knots and other defects, thoroughly dry before placing them in the building, and framed as directed. The floor joist in the first story of the front building will be 3 " x 14" placed on the walls 12" from the centers and resting on the wall not less than four inches (4 in.) The second story floor joist will be 3" x 14" placed on the wall 12" from centers." The third story or ceiling joist will be 2" x 10" placed on the wall 12" from the centers. The rafters will be 2" x 6" placed on the buildings two feet (2 ft.) to centers. All header and trimmer joists will be made out of two pieces three inches thick, well spiked together and framed with tusk and double tenon, which will run through the trimmer. All headers will be framed to the trimmer and to rest on a wrought iron stirrup. The trusses in the roof over the chapel and those over the hospital will be framed as shown on section, neatly dressed and the corners chamfered. The main rafter will be 8 in. x 12 in., all others, including braces, will be 6 in. x 10 in. framed and bolted as shown on plans and details. The bolts to be used will be ¾ in. with 2½ in. washers, approved by the architect. The posts in the basement will be 12 in. x 12 in. neatly capped, as shown on plans and sections. The girders in the laundry and prisoners dining-room will be 12 in. x 14 in. neatly dressed and chamfered as per detailed drawings. The truss girders over the main entrance hall in the first story will be framed

out of 4 in. x 14 in. with a ½ in. by 4½ in. wrought iron cambered plate put in between each piece, with three-fourths inch (¾ in.) by four in. (4 in.) heel plate at each end of the beams, and to have three three-fourths inch (¾ in.) bolts to each. The beams will be bolted together with three-quarter inch (¾ in.) bolts, placed two feet from centers with large cast iron washers on each side. The purlines will be formed with 3 in. x 14 in. timber in the halls. The joist will be cogged down on the girders, and other bearings one half an inch. The purlines in the roof will be 4 in. x 10 in., the hip rafters 3 in. x 10 in., the valley rafters 4 in. x 10 in., the ridge pole will be 4 in. x 12 in., worked with a bead on tops, as shown on section. The uprights in cell-house, supporting the purlines will be 4 x 6 in., placed eight feet (8) from centers; ceiling joist over cell-house will be 2 in. x 8 in., placed two feet from centers. The collar beams will be 2 in. x 6 in. on every pair of rafters. The trusses between main building and cell-house will be formed of 4 in. x 6 in. with 4 in. x 6 in. king post. The straining beams will be 4 x 8 in., with two one inch (1 in.) wrought iron bolts with cast iron washers under head and nuts. The flooring joist will be bridged with 2 in. x 4 in., bridging every ten feet between bearing, in each of the floors and ceilings, and furried with one by two inch (1 in. x 2 in.) furring, placed twelve inches from the centers, all to have two twelve-penny nails to each bearing. The walls in the front building will be plugged with good hard wood plugs, not less than three inches long, every eighteen inches as you rise, and twelve inches from centers as you run, and furried with one by two inch (1 in. x 2 in.) Oregon pine furring; also furry all partitions with diagonal furring, laid twelve inches from centers, with two twelve-penny nails to each bearing. The studding throughout the building will be two by six inches (2 in. by 6 in.), placed twelve inches (12 in.) from centers, with two courses of herring bone bridging of two by four inch (2 in. x 4 in.) Oregon pine, with two twelve-penny nails to each end. Also furry partition on each side with one by two inch (1 x 2 in.) Oregon furring, placed twelve inches from centers with two twelve-penny nails to each bearing, diagonally; joist in guard turrets will be 2 in. x 10 in., 12 inches from centers.

SCAFFOLDING.

The stone contractor will be required to build scaffolds on each side of the walls, and work from each side, and leave the scaffolds up and keep them in repair as long as they may be deemed necessary by the architect for the completion of the works.

FLOORING.

The floors throughout the building will be laid with one and one fourth inch (1¼ in.) Mendocino pine flooring, not more than three inches wide including the tongue, all to be thoroughly dry and clear and stacked up on the ground for not less than four months before laying and drove up and top nailed with two twelve-penny nails to each joist all joints to be well broken and smoothed off, and all nail heads to be sunk; and all nail holes to be filled with putty.

WINDOW FRAMES AND SASH.

The whole of the window frames throughout the building will be

made as shown on elevations, sections, and detailed drawings, and to have two-inch lipped sash with box frames. All sills are to be two inches (2 in.) thick, weathered and rebated with one and one fourth inch (1¼) Mendocino pine pully stiles, and one inch (1 in.) back linings, one inch (1 in.) outside and inside casings, and two inch (2 in.) moulded staff bead on outside. The sash will be two inches thick, moulded, made with eight lights to each window, and glazed with 21 oz. crystal sheet mettle, chances No. 1, all to be bedded, tinned, and glazed in the best manner; and provided with Blake's two inch (2 in.) patent axle pulleys, and hung with the best patent line and cast iron weights, and fastened on the meeting rails with good, strong brass sash locks. The lifts will be plain brass with two at the bottom sash and one plate at the top of sash, with cue rods for each floor of main building.

INSIDE BLINDS.

The windows in the second and third stories of the front building will be provided with inside blinds one and one fourth (1¼ in.) thick, made in four fold and cut on meeting rails of sash, and to have rolling slats with pivot and hung with one and one fourth inch (1¼ in.) brass flaps with brass screws; also provide a plain brass shutter bar to each section, as directed; all to be made of white cedar, and all to be hand smoothed without sand paper; care will be taken to select wood of uniform color; all to be made out of thoroughly seasoned and kiln dried lumber.

INSIDE FINISH.

The inside finish, where there are inside blinds, will be trimmed with white cedar wood work, thoroughly seasoned and kiln dried on the ground. Care must be exercised to see that there shall be no defects or stained wood, and where it can be seen when the work is finished, all to be neatly hand plane smoothed before it is set up. The windows will be trimmed with panel backs, elbows, and soffits, with plain jamb linings. The casings will be seven inch (7 in.) wide by one and one fourth inch (1¼ in.) thick, with neat raised mouldings one and three fourths inch (1¾ in.) thick by three inches (3 in.) wide, and two inch back band by two and three fourths inches (2¾ in.) wide, all to be set on an appropriate plinth, and constructed as directed. The jambs of the doors will be finished in the manner heretofore described with paneled faces in the main halls in second and third stories, all others to be plain. The base in the second and third stories will be fourteen inches (14 in.) high, including the moulding, which will be three and one half inches (3½ in.) wide by one and one half inches (1½ in.) thick; the base will be open-faced, as per detailed drawings, worked out of one and one half inch stock and dadoed down into the floor one half inch deep. The inside finish in the guard rooms will be the same as that in the front part of the building, except it will be redwood; that in the laundry, kitchens, dining-rooms, and small apartments in the first story will be finished with plain casing with neat back band, all to be put up in the best manner and as directed.

WAINSCOTING.

The dining-rooms, laundry, kitchens, store-rooms, entrance-hall, and

hall in the third story, the hospital, and passage-ways from cell-house to chapel, and also from cell-house to hospital, will be wainscoted up three feet high; also, the bathrooms and lavatories will be wainscoted up five feet six inches high, and neatly capped with moulded caps—with neat terminal at the different openings. The lumber to be used will be redwood and Mendocino pine, neatly smoothed and beaded and put up with not less than three bearings for nailings, all to be put up in alternate strips and neatly blind-nailed, not more than three inches wide over the tongue. The interior of the chapel and hospital will be neatly wainscoted in the roof, with alternate boarding of redwood and Mendocino pine, put on diagonally, and finished with a neat chamfered paneling, as shown on sections. The sides will be wainscoted all around four feet and six inches (4 feet 6 inches) high, and neatly capped, as shown on plans. All of the above work will be neatly hand-plane smoothed, and put up with blind-nailing on every bearing. Terminals at all the openings to receive the capping. The inside of the linen lift will be wainscoted up and down, same as above; the outside will be formed same as the room finish through which it passes. Wainscot up the back string of each staircase three feet high above risers, directly under the capping, all as directed.

SKYLIGHTS.

The skylights will be made as shown on plans and detailed drawings; all the timber used will be Oregon pine, with two by four inch (2 in. x 4 in.) studding around the well-hole for the skylights. The trimmers around the skylight will be 4 in. x 8 in., framed together and well secured to the uprights top and bottom, as directed. The joiner work for the skylights will be made of good dry redwood, as shown on detailed drawings, with louvers one and one half inch thick, and neatly capped. The sash will be made of sugar pine, two and one half inch thick, with iron bars made and screwed to the frame work every nine inches (9 in.), and glazed with one half inch (½) corrugated glass; all to be put in in full sheets and to run down to the lower edge of the frame work, and to be secured to the frame work by means of caps screwed down on them, as will be seen on the detailed drawings. The ridge pole will be three inches thick by seven inches wide (3 in. x 7 in.), and all to be made perfectly water tight, by letting the tin from the roof run up and nail down to the wood work, and nailed with one and one fourth inch tin nails, driven not more than one half inch apart.

ROOFING.

The entire rafters of the main building and cell-house will be covered with Oregon pine flooring boards, one inch thick and not more than eight inches wide, tongued and grooved, and nailed with two twelve-penny nails to each rafter, the joints to be broken every board, and driven up close, and covered with I. C. charcoal tin, put on with standing groove, with one cleet to each sheet, and well secured to the roofing boards. There will be a lock every fifteen feet around the building, formed by turning the upper sheet one half of its width under, and the one below one half its width over, and lock together, to give room for contraction and expansion; all of the above work will be painted two coats on the under side with Prince's metallic paint and boiled linseed oil paint. All joints running longitudinally with the

eaves will be locked and resin soldered, as directed. Care must be taken to remove the resin from the surface of the tin before the paint is applied; all flashings will be put into the chimneys out of four-pounds sheet lead, put into the joint of mortar two inches, and wedged in with gas hooks every brick, to join to the tin work and make water tight. There will be a boot and sleeve made around the galvanized iron ventilator, and made perfectly water tight. The lower edge will run down to and connect with the gutter, as directed by the Architect; all the valleys will be put in with a flat seam, and resin soldered, and made out of double X charcoal tin; also the deck portion of the roof on main building.

LEADERS.

There will be lead outlets put out through the stone gutter and well secured to the stone work, and made perfectly water tight—the lead to be ten pound to the square foot. There will be cast-iron leaders put up where shown on the plans, and run down and connected with the sewer, which will be branched off from the sewer for the water-closets to the point where the leaders are, all to be connected with asphaltum and gravel concrete.

DOORS.

The doors throughout the building will be made of Port Orford cedar (white cedar), thoroughly kiln dried and free from defects or stains, all to be two and one fourth inches (2¼) thick, made with four panels, three feet two inches by eight feet (3 ft. 2 in. x 8 ft.), with raised panels and mouldings, all to be put together with mortice and tenon, and glued at the shoulder on the inside; also wedge, and glue the wedge only to the tenon (not to the mortice). The sliding doors will be two and one half inches (2½ in.) thick, made with six panels, raised six feet six inches by nine feet six inches (6 ft. 6 in. x 9 ft. 6 in.), with raised mouldings, all to be made and finished properly, and to have hard wood treatment throughout the building. Transoms over doors where marked on plans with T, glazed with 21 oz. Chances crystal sheet metal glass No. 1.

HARDWARE FOR DOORS.

The doors throughout the building will be hung with three hinges to each, with loose joints five by five inches (5 in. x 5 in.), black japanned, with silver-plated acorn tips. The locks will be three-tumbler five-inch (5 in.) mortice locks, with brass faces, brass bolts, brass knobs, brass strikes and keys, and trimmed with silver-plated rose and escutcheons, and white porcelain knobs; and to be worth not less than twenty-five dollars per doz. ($25), to be approved by the Architect. There will be door fenders put in the base, of Wendel's patent doorstop and fastener, the wood portion to be made of Cal. laurel, with gum heads for the doors, all to be placed where directed by the Architect. The sliding doors will be run on the best quality of brass track, cast and planed with five-inch patent noiseless sheaves. The locks will be No. 33 of Russell's and Erwin's manufacture, with silver-plated faces, escutcheons, and trimmings. The stop at the top will be silver plated. The front aad outside doors will have locks worth not less than ten dollars ($10) each, with duplicate night and day keys, and silver-plated escutcheons and white porcelain knobs.

VENTILATORS.

The ventilators from the cells will be made according to the detailed drawings, out of No. 12 galvanized iron, from the cells to the roof, and above the roof will be made out of No. 20 galvanized iron; each top will have a band of wrought-iron around it, one fourth inch by one inch (¼ in. x 1 in.), and be connected with a three-fourth inch (¾ in.) round iron rod and anchor back on the roof at an angle of 45 degrees. There will be a sleeve run down over a boot that will be fastened to the tin work, to prevent leaks, as directed.

WROUGHT-IRON ANCHORS.

There will be one and one-fourth inch wrought-iron rods run from north to south, at the second story floor joist, a distance of one hundred and twenty feet, with a turn buckle. Said rods will have a ten by ten inch (10 in. x 10 in.) wrought-iron head, three-fourths inch (¾ in.) thick, put into the walls as directed, and turned up until the whole is properly tautened. The girders will have three one-inch round-iron bolts to each end, with six by six inch (6 in. x 6 in.) wrought iron heads, one-half inch (½ in.) thick, and a large 2 1½ in. cast-iron washer on the side of the timber, all to be properly screwed up as directed.

FURRING, LATHING AND PLASTERING.

The entire apartments in the front portion of the building back to the cell house, and the ceilings of the cell house, including around the well-holes of the sky-lights, will be furried with one by two inch (1 in. x 2 in.) Oregon pine furring, laid on twelve inches (12 in.) from centers; the partitions and ceilings to be put on diagonally, with two twelve-penny nails to each bearing; the outer walls will be put on vertical with a hard wood plug three inches long, and one half by two inches wide, driven in all the leveling courses, which will be every eighteen inches as they will rise, except when there is wainscoating described in the specifications. The entire walls and ceilings, except where otherwise specified, will be lathed with one inch by three eighths inch (1 in. x 3-8 in.) thick, Oregon pine lath, put on the walls and ceilings with not less than five nailings to each lath, all to be laid three eighths of an inch apart, and the joints broken every seventh lath. All the angles will be made solid, by putting angle furring and plaster, the whole with a good scratch coat composed of Santa Cruz lime, goat hair, and the best sharp sand to be found in the river bed. None but the coarsest sand will be accepted. All to be scratched diagonally each way, not more than three fourths of an inch (¾ in.) apart. The second coat will be put on to an even surface with a darby, and floated down while green. All angles to be rubbed out to form a perfect angle without cutting with the trowel. The third coat will be put on, not less than one eighth of an inch thick, to be laid on with a darby and well distributed, and then thoroughly worked down to a smooth surface as directed.

The first coat will be composed of one barrel of Santa Cruz lime, four barrels of sand, and ten pounds of goat hair. The second coat will be composed of one barrel of lime, and four of sand. The third coat will be composed of one barrel of lime, one of plaster of Paris, and one and

one half of white Monterey sand, unless that on the premises is found to be its equal.

All the lime used in the walls and ceilings, will be slacked and racked off in vats, and left to get cold before it will be mixed with the other ingredients. All the above to be accurately measured in boxes made for that purpose, and well mixed together by manual labor, so as to thoroughly incorporate every particle of the lime, sand, hair, and plaster of Paris, together, and none to be allowed to go on the walls, unless mixed ten days. All of the above work to be done straight and true to the grounds, which will be put on not less than one inch thick. There will be cornices run in all the rooms on the second story, except in the Guard Armory, and guard room, and also in the third story of the building in the central halls and officers rooms, all as shown on the detailed drawings. There will be a neat plaster center stuck, where shown on the plans, in the second and third stories of the building, all as shown on detailed drawings. All work must be left entirely smooth, and the building cleaned out, after the plastering is completed, and all defects retouched and made good.

DEAFENING.

The entire floors in the second and third stories, will be deafened, by nailing a strip of one by two inch (1 in. x 2 in.) Oregon pine, about three inches below the top of the joint, with twelve-penny nails ten inches (10 in.) apart, and the whole filled in with one by four inches, (1 in. x 4 in.) redwood cut in and nailed at each end. None to be laid more than half an inch (½ in.) apart; and the whole to be plastered over with a coat of mortar, three fourths of an inch (¾ in.) thick, and left smooth. Said mortar to be composed of fine straw, cut one inch (1 in.) long, and one barrel of Cave Valley lime, to about ten barrels of sand, all to be put on after being made up, about ten days. Great care must be exercised to thoroughly mix and combine every particle of lime, straw, and sand together, and to fill in all difficult places, those usually overlooked in contracts of this character.

ENTRANCE PORCHES.

The front and side entrance, porch and steps to the same, will be built with granite up to the floor of said porches, which will also be arched over with groin, worked out of four pieces to each section, as shown on detailed drawings, all to be neatly point hammer dressed, with a neat margin draft, one and one half inch (1½ in.) wide, joints to be one fourth of an inch wide. That portion of the porches which is found above the second floor, will be constructed with redwood, as shown on elevations, detailed drawing and sections, and as directed. The entire roof will be formed of tin, and the roof will come under our general roofing specifications with standing-ground. Two outlets and leaders will be carried down to and connect with the sewer as above.

WALL PLATES AND JOIST IN GUARD TURRETS.

The wall plates on all the walls throughout the building, will be Oregon pine, sound and well seasoned, four by twelve inches (4 in. x 12 in.), well bolted down to the stone walls, every six feet with a three-quarter inch (¾ in.) bolt, not less than one foot and six inches, (1 ft. 6

in.) long, and to have a three inch (3 in.) cast iron washer screw down with a one and three-quarter nut. The bottom end of said bol will have a wrought iron plate three eighths of an inch (3-8 in.) thic all to be properly bedded and set in cement mortar.

SHELVING.

The closet and store rooms throughout the building will be made out Oregon spruce, neatly hand-plane smoothed on both sides. with rebate cleats with not less than six shelves in height in the store-rooms and pa tries; also all other closets will have from one to four shelves put up as ma be directed. There will be not less than twelve drawers made and put each of the store-rooms and pantries of sizes as directed, all to be mad out of Oregon spruce, with white Port Orford cedar fronts; no drawe will be less than four inches high nor more than ten, and will be fro twelve to twenty-four inches deep and from twelve inches to three fe long. The shelves will be one and one-fourth inch ($1\frac{1}{4}$) thick, and fro twelve to twenty-four inches wide with neatly nosed edge, with prope supports as directed. Linen lift to be built where shown on plans wit flush framing from basement to the third story of the building, wit bead and flush doors to each story, to be made of sizes as shown on th plans. The doors will be hung with 4 in. x 4 in. black japanned butt with silver plated acorn tips and mortice locks; each division of drawe will have one brass drop handle with a good lock, with duplicate ke to each, to be approved by the Architect. Some of the drawers will b divided in six divisions.

SINKS AND WASH-TRAYS

Will be made out of sugar pine, dadoed together and drove up wit white lead paint; all of the lumber used must be perfectly clear an thoroughly dry, and to be not less than two inches (2 in.) thick, mad with covers. The covers for the wash-trays will be one and one hal inch thick, and will be hung with brass butts and screws; the sinks wi be made not less than six feet nor more than eight feet long; not les than two feet wide, nor more than two feet eight inches wide, nor mor than eight inches high. The wash-trays will be made as per details d the sizes as shown on plans.

PAINTING, SANDING, GRADING, AND VARNISHING.

The entire wood-work on the outside of the building will have no less than four coats of pure Atlantic white lead and raw linseed oi paints, and not less than two coats of sand, all to be thoroughly dis tributed over the surface and to be left in imitation of the granite. Th wood-work of the inside of the building will have three coats of Til den's furniture varnish No. 1, laid on top of a thin coat of shellac, an to be thoroughly rubbed down with very fine sand paper after each o the three first coats; and finished with a flowing coat. The floors i the corridors will have three coats of raw linseed oil paint, thoroughly rubbed in the last, to be mixed with wax, and to be left entirely smooth The tin-work on the roofs will have three coats of English red lead and boiled oil paints, care being taken to remove all the resin before th paint is applied. The sash-runs will have two coats of raw linseed oi well rubbed down, the last coat to be mixed with beeswax. Stain all

door-saddles two coats with raw linseed oil colored as directed. Great care must be exercised to keep the oil and paint off from the floors and walls and the trimmings, and leave the entire work clean.

DOOR—SADDLES.

The door-saddles will be made out of white ash and put down with white metal screws, as directed.

ENGINEER'S REPORT AND EXPLANATION.

The diagram is a correct survey and calculation, made of the number of cubic yards of excavations and embankment, which will be seen by the following report. The stations on the center line are 25 feet apart, and extend from ten feet east of station 12, or station 12 plus 10 at front wall, to station 32 plus 10 at east end of cells, a distance of five hundred feet. The first one hundred and thirty feet from station 12 plus 10 to station 17 plus 15, are for the officers' quarters, and must be graded to a level 45 feet above high-water mark, to a width of sixty feet on the south side, and eighty-five feet on the north side of the center line. The remaining three hundred and seventy feet are for the cells, and must be graded to a level of 61 feet above high-water mark, and to a width of forty feet on each side of the center line, and the eastern ten feet from station 17 plus 15 to station 18, will be cut down sixteen feet lower, or to the level of 45 feet above high-water mark. The excavations will have a side slope of 1 to 1. The depths of cutting in feet, are shown in red figures where the minus sign (—) precedes the numbers. They indicate the depths of filling or the depths of the natural surface below grade. The number of cubic yards of excavations is indicated by blue figures. The amount of excavations for the cells is 9,796 cubic yards. Officers' quarters, 5,625. Total excavations, 15,421.

BIENNIAL REPORT

OF THE

State Capitol Commissioners,

FOR

THE YEARS 1874 AND 1875.

1—(17)

G. H. SPRINGER........STATE PRINTER.

REPORT.

OFFICE OF THE BOARD OF STATE CAPITOL COMMISSIONERS,
SACRAMENTO, November 1st, 1875.

[H]is Excellency,
ROMUALDO PACHECO,
Governor of California:

The following report of the State Capitol Commissioners, for the two [y]ears ending November first, eighteen hundred and seventy-five, is [r]espectfully submitted.

Since the date of our last report, there has been expended on the Cap[i]tol building and grounds, as follows:

[T]o November 1st, 1874	$69,022 51
[T]o November 1st, 1875	9,364 42
Total	$78,386 93

The greater portion of this expenditure was made upon contracts already explained, and in placing the stone balustrade and the statuary; and it makes the total cost of the structure, to November first, eighteen hundred and seventy-five, two million four hundred and forty-nine thousand four hundred and twenty-nine dollars and thirty-one cents. The system of pipes provided for irrigating purposes, has proved to be all that is required. The trees and shrubs attained a vigorous growth, and the lawn and parterre flourished finely throughout the Summer, attracting many visitors by their exceptional beauty. The basins that were prepared for fountains have been filled with earth and converted into flower-beds, for the reason that no funds were available to erect suitable fountains. The earth can be removed at any time, if deemed advisable, and the original purpose adhered to.

No appropriation having been made at the last session of the Legislature for the purpose, the Commissioners have not caused the building to be painted, and desire to call your attention to the fact that such painting is greatly needed, for purposes of actual preservation as well as for proper ornamentation. It will be observed that the graveled walks in the grounds, answering their purpose admirably in dry weather, yet require to be suitably prepared for Winter use. Also, that the tempo-

rary steps in the grounds should be replaced by something more dural and more in consonance with the building and its beautiful surrou ings. The following estimate for such purposes has already been ma

Twelve flights iron steps, posts, and vases	$25,0
Twenty-four hundred feet—three sides—cast and wrought iron railing, lamp posts, etc	24,0
Two principal carriage entrances, arched	20,0
Three smaller foot passages	15,0
Total	$84,0

When the present Board assumed control of the Capitol it was so f advanced toward completion that the construction of a suitable flight steps to approach the main entrance would have involved a change i the plan of work already done, and an expenditure larger than w thought advisable; and it was therefore decided to delay such constru tion until a more favorable opportunity offered. It is apparent that th building never will present a completed appearance until such steps a erected.

THE CAPITOL PARK.

The grounds embraced in the Capitol Park have been properly i closed within a common fence, but no improvement of them, beyond partial grading and fertilization, which was done without cost to th State, has been attempted, owing to the lack of any appropriation fo such purpose.

The marked success which has attended the cultivation and orna mentation of the Capitol grounds proper, shows that with due attentio and outlay the park can be made one of great beauty and value.

THE STATE ARMORY.

By an Act approved March thirtieth, eighteen hundred and seventy four, the Commissioners were charged with the duty of converting portion of the building known as the Governor's Mansion, into a Stat Armory; and the sum of eight thousand dollars was appropriated there for.

On the sixth of April ensuing, the Board began the work, which wa completed on the twenty-ninth of June following. By careful manage ment the appropriation was made to complete the work, and was ex pended as follows:

Carpenters	$2,445 1
Brickmasons	212 5
Plasterers	190 3
Painters	213 8
Plumbers	228 7
Laborers	505 2
Carried forward	$3,795 8

Brought forward	$3,795 88
ımber	1,685 04
ırdware	663 39
me and cement	62 94
ıints and glazing	369 99
on work	147 23
ırble work	14 04
ood work	243 39
umbers' materials	217 04
re hose	179 57
on pipe	10 62
evator	174 67
hitewashing	189 00
ayage	86 13
scellaneous	161 07
Total	$8,000 00

The armory is a secure and commodious one, the work done being ıin and durable. An elevator, to facilitate the storing of heavy ıterial, was erected, and carbolized hose was placed in position to guard ainst danger from fire.

THE STATE PRINTING OFFICE.

By the provisions of the Act above referred to, the Commissioners ıre required also to erect and construct within the building named, a ıtable establishment for a State Printing Office, using therefor the n of twelve thousand dollars, which had been appropriated.

On the fifth day of January last, the Board proceeded to plan the ırk, which was commenced on the twenty-third day of February, and now virtually completed. The following expenditures have been ıde:

ırpenters	$1,970 00
ickmasons	222 50
ınters	730 50
asterers	158 34
ıchinist	217 00
umbers and materials	264 92
ıborers	240 37
ımber	904 36
eam engine and fixtures	1,003 97
iler	958 00
oodwork	689 48
on work	21 00
me and cement	70 94
ick	336 00
n roof	60 00
Carried forward	$7,847 38

Brought forward	$7,847
Fire brick	44
Sand	20
Hardware	325
Pump	135
Paints, etc	758
Blacksmithing	36
Whitewashing	15
Drayage	10
Miscellaneous	50
Grading streets	378
Fencing, and partition walls	437
Total	$10,059

In preparing this portion of the building for a printing office, care been taken to isolate it completely from the armory, as far as possib

In the placing of steam machinery, the greatest care has been ta to attain safety from fire; and the machinery itself, including the boi was properly and fully tested before being accepted.

In view of the facts that the building never was properly pain that it was decaying in consequence, and that the appropriation w ranted the expenditure, the Board caused the entire building to thoroughly painted.

If the materials for furnishing the office were now in the build the Commissioners could determine accurately what further out would be necessary to complete the work; but until they arrive, it not properly be decided where the work of construction ends, and t of furnishing begins.

Assured that the one thousand nine hundred and forty dollars fifty-five cents remaining of the twelve thousand dollars appropria will be ample to finish the construction, the Board take pleasure turning it over to their successors in responsibility.

DRURY MELONE, Secretary of State,
F. BAEHR, Treasurer of State,
Commissioner

REPORT

OF THE

BOARD OF COMMISSIONERS

OF THE

STATE NORMAL SCHOOL BUILDING.

1—(16)

G. H. SPRINGER.........STATE PRINTER.

REPORT.

To His Excellency,
ROMUALDO PACHECO,
Governor of California:

SIR: The Commissioners of the State Normal School Building have the honor to present the following statement:

The fund appropriated by the Legislature of this State for the completion of the State Normal School building, and for the improving of the grounds, was twenty-five thousand dollars, with the addition of eight hundred and forty-eight dollars and twenty-nine cents delinquent tax, and one hundred and ninety-seven dollars and six cents received by the sale of refuse lumber and unused material, making the total amount expended upon the building and grounds twenty-six thousand and forty-five dollars and thirty-five cents. This we expended as follows:

In addition to the work already done in the basement story, we finished all the plastering, with the exception of two rooms that are not used. All the woodwork, pillars, etc., of the large recreation room have been painted two coats; the ceiling of the same, three coats. Two class-rooms and the main hall we painted three coats, grained oak, and varnished. Janitorial and wash-rooms have been painted two coats throughout.

In the first story we expended eight hundred dollars towards the erection of a reference library in the northwest room of the main building. All the windows and blinds have been rehung. All the class and toilet-rooms, *in* addition to the two coats already given, have received one coat of paint, grained oak, and varnished two coats. The blinds have all received two coats of varnish. All the halls, reception-room, reference library, office, and corridors as far as the first landing, have been painted two additional coats of paint and grained laurel, black walnut, and oak, and varnished two coats.

In the second story the finish has been put on in the main halls, corridors, and class-rooms, water-closets, and wash-rooms; all the doors, windows, and blinds hung, with fastenings complete. In the exhibition hall, the arch over the stage and the gallery seats have been built, and all the unfinished carpenter work completed. All the plastering left unfinished has been completed, and the center-pieces and brackets put up complete. The ceiling and walls of the exhibition hall have been tinted in water colors. All the class, toilet, and wash-rooms, halls, cor-

ridors, and closets, have been painted two coats. The exhibition h has received three coats of paint and finished in party colors. All blinds have been oiled one coat. The plumbing has been completed the water-closets and wash-rooms.

In the third story, the finish has been put on in the main hall a corridors and library room. All the doors, windows, and blinds hu with fastenings complete. The plastering left incomplete has be finished in the main halls and corridors and library room, and brack and center-pieces put up. The class rooms have received one coat plaster. The library room has been painted one coat. All the ha and corridors painted two coats. All the blinds have been oiled, a the seats in the exhibition hall oiled and varnished, three coats. Sta rails, balusters, and newel posts have been put up on all the stairs co plete except two flights in the main corridors already finished. All t rails, balusters, etc., have been oiled and varnished two coats. T risers and stringers of the stairs have been painted three coats, grain oak, and varnished. The steps have been stained. The walls of t bell deck in the tower have been sheathed, and windows covered wi wire-cloth.

The work that has been done on the outside of the building is follows:

The brick work of the basement story has been cemented and oile The entire basement, including stair-rails and sides, have been paint three additional coats, with two coats of sand. North side of mai building has received one additional coat of paint and sand. South si of main building two additional coats of paint and sand. Both wing have received two additional coats of paint and sand. All the porc floors and outside steps have been painted two additional coats. All th roofs of the building have been painted one additional coat. The iro crestings of both wings and tower have been painted three coats. Th wire-cloth over the windows in the tower have been painted two coat All the sash have been painted two additional coats.

We have improved the grounds as follows: The present suppl water-pipe not furnishing sufficient water for the building in case o fire, we laid five hundred and twenty-four feet of four-inch cast-iro pipe, connecting with the water company's new main, and also erecte a hydrant on each supply-pipe at a suitable distance from the building We also laid six hundred and thirty-two feet of three-inch cast-iron ga pipe.

We have built four walks leading from different points of the squar to the building. We have also done some filling in and grading abou the building.

We herewith submit a statement of the receipts and expenditures.

J. A. QUIMBY,
T. H. SINEX,
CHARLES WELTI,
Commissioners State Normal School Building.

RECEIPTS AND EXPENDITURES.

appropriation by Act of March 25, 1874	$25,000 00	
State Normal School Building delinuent tax	848 29	
received by sale of unused materials, etc.	197 06	
		$2,273 08
lumber		1,171 36
hardware		2.664 00
painting materials		1,013 22
plastering materials		693 91
plumbing and tinning		228 25
marble mantels		125 00
legal services		110 04
printing and stationery		375 00
insurance		5,684 62
painting		5,533 65
carpentering		2,292 50
plastering		603 00
labor		196 77
clerk		1,153 32
water and gas pipe		1,374 88
discount on warrants		527 75
earth and gravel		25 00
traveling expenses		
Total receipts and expenditures	$26,045 35	$26,045 35

(o)

Third Biennial Report

OF THE

TATE BOARD OF HEALTH

OF

CALIFORNIA,

FOR THE YEARS 1874 AND 1875.

SACRAMENTO:
G. H. SPRINGER, STATE PRINTER.
1875.

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REPORT OF THE PERMANENT SECRETARY.

PAGE.

REPORT

OF THE

STATE BOARD OF HEALTH.

1—(1)

MEMBERS

OF THE

State Board of Health of California.

HENRY GIBBONS, Sr., M. D., President........................San Francisco
* JAMES MURPHY, M. D........................San Francisco
F. W. TODD, M. D........................Stockton
A. B. STOUT, M. D........................San Francisco
LUKE ROBINSON, M. D........................Colusa
J. F. MONTGOMERY, M. D........................Sacramento
THOMAS M. LOGAN, M. D., Secretary State Board of Health.....Sacramento

STANDING COMMITTEES.

On the Salubrity of Public Institutions, Schools, Hospitals, Prisons, Factories, etc.—Dr. A. B. Stout, Dr. J. F. Montgomery, Dr. F. Walton Todd.

On Statistics Relating to Life and Health, Modes of Employment and of Living, the Comparative Healthiness of Different Localities.—Dr. F. Walton Todd, Dr. James Murphy, Dr. H. Gibbons, and Dr. Luke Robinson.

On Intoxicating Liquors, Inebriate Asylums, Pathological Influence of Alcohol, etc.—Dr. H. Gibbons, Dr. James Murphy, and Dr. J. F. Montgomery.

Of these different committees, the Secretary is made, by resolution of the Board, a member, as well as *ex officio* the Executive of the Board.

* Dr. Murphy was commissioned by Governor Pacheco, on the fifteenth of March, eighteen hundred and seventy-five, to supply the place of Dr. Lane, absent in Europe.

GENERAL REPORT TO THE GOVERNOR.

Office of State Board of Health,
Sacramento (Cal.), July 1st, 1875.

His Excellency,
Romualdo Pacheco,
Governor of California:

[G]overnor: In compliance with the requirements of the law estab[lish]ing a State Board of Health, I have the honor to submit the accom[pan]ying report. While performing this official act, permit me to tender congratulations on the steady advance of the State in public health, [whi]ch is public wealth. This is attested by the constantly diminishing death-rate, as seen in the chapter of mortality statistics, and which already given to California the title of the "Sanitarium of the [Wor]ld."

[W]ithout pretending that anything more than a good commencement been made in our organized efforts to search out the most important [cau]ses of disease and death, in order that they may be avoided, there is reason to believe that the direction of the public mind to sanitary [mea]sures, through the mere fact of the creation of a State Board of [Hea]lth, and the dissemination, by these biennial reports, of hygienic [kno]wledge, has already prevented, and will continue to prevent, in some [deg]ree, the unnecessary waste of life.

[I]t is only now that we are beginning to realize how vast a proportion [of b]oth our illnesses and deaths are due to purely and easily preventable [cau]ses, and the knowledge has hardly yet fairly started us into action. [An]d this remark applies not to California alone, but to every part of civilized world.

[L]ook at London, with her reconstructed sewerage. What originated [and] put into operation this colossal achievement of sanitary engineering, the awakened consciousness that thousands, nay, more than a hun[dre]d thousand of deaths, could be annually traced to zymotic diseases, [gen]erated and propagated by filth, noxious gases, tainted water, and the [lik]e—all of which factors of disease might be extinguished or neutral[ize]d by the prompt and energetic administration of well known sanitary [law]s.

[A]part from the sickness and mortality arising from the material [cau]ses, just mentioned, there is a vast amount of preventable disease [att]ributable to social causes, which legislative measures, or sanitary [pre]cautions, do not reach. So far as these causes are concerned, the

hopes of progress and improvement in California, as already st
must rest, for the present, on education, wide-spread and general.
fundamental principles of domestic as well as public hygiene
become matters of intelligent conviction amongst all classes, and
cially amongst the wealthier classes, that they may help those o
poorer, who are unable to help themselves. If, for instance, unw
some overcrowding were prevented by an adequate supply of com
ble dwellings for the poor, and if all those dwellings were well dr
and ventilated, and furnished with an ample supply of good water
only might many preventable diseases become controlled, but a nu
of other evils, now acting and reacting on each other, would be e
nated or greatly mitigated. Each valuable influence, put into opera
is a potent ally of every other, and this is the most encouraging fea
of what we are now considering; amendment and reform, in one p
brings amendment and progress in all others. We cannot improv
surroundings of the depraved without, *pro tanto*, raising the moral
ings, and lessening that craving for stupefying strong drink, created
stimulated by breathing fœtid air. We cannot, without the univ
establishment of wholesome and decent homes for the poor, mini
the premature deaths caused by the want of such, or vivify the pos
sapped health and strength of thousands yet unborn.

It generally happens, whenever such sanitary questions as these
raised, that "education" is pronounced in a dogmatic and unreason
way, in connection with schools, as the remedy. Now, education is
business of home; instruction is the work of the schools. It is at h
that the feelings, affections, habits, and aspirations which govern
conduct of the future life, are matured; and the happiness or mis
the success or failure of the man, depends upon the training of
child. What can be expected of the neglected, street-running c
when ripened into the full fledged vagabond? Long ago Guizot s
"Home is the domestic country of the man," and he pointed to the
tivation of the family ties as essential to the growth of true patriot
The President of the British Social Science Association declared
eighteen hundred and sixty-six, his belief, that in order "to improve
moral condition of the people, we must improve their domiciliary c
dition; and in doing so, we should destroy their appetite for spiritu
liquors." Intoxication was almost forced upon the people by the
pressing influence of the localities in which they lived. Having g
for hours together through filthy localities, he could assert from exp
ence that the atmospheric influences, the sights, and the smells he
posed himself to, produced such a weakness and faintness that he w
have given anything for a glass of spirits to sustain his sinking nat
If that were the case with himself, who was generally well fed and
good health, what must be the case with those who live in such pl
perpetually?

There are, it is feared, multitudes in all our large towns so hea
burdened with the load of a vitiated heritage, and so hemmed in by
barriers of foul air, filth, and want, that teaching and preaching
only be felt as bitter mockeries, unless these barriers are first remov
Therein lie the duties of sanitary authorities, and only in compuls
measures is there any reasonable hope that amelioration and enligh
ment may penetrate to these depths.

Allowing even a large estimate for the alleviation of prevent
diseases, subjected to our present sanatory administration, still it is
be apprehended that the waste of life would, nevertheless, remain

less as it is appalling. What is wanted under these circumstances
ower—coercive power, delegated under legislative restrictions, and
cised solely for the improvement of the public health.

SANATORY LAWS MUST BE ENFORCED.

this country sanatory laws, to a certain extent, are permissive. In
t of our cities and towns we find but little effort made to remedy
state of neglect, still existing in ill-ventilated buildings, and
rained and ill-drained localities. The local authorities, to whom are
rred the execution of measures recommended by our Boards of
lth, are not always imbued with the true spirit of humanity.
cy considerations are with them often of greater importance than
question of life and death, and they too often overlook the hard
, that while they remain inactive, disease and death do not.
ake San Francisco for example. With the full knowledge, derived
n the experience of all the large cities in the world, of that most
gerous, if most natural of all tendencies in a productive and
ancing country—the concentration of population into great towns,
hout any adequate effort to provide for it, or forestall its conse-
nces—we are scarcely dreaming of the necessity of expanding our
al garments, as our social body is outgrowing them. The same
nicipal government, or rather the same municipal makeshifts, which
iced for San Francisco fifteen or twenty years ago, we seem to think
l answer for the vast commercial mart of to-day. The same drain-
system, the same sort of water supply, the same haphazard mode
multiplying buildings, which answered for a town of fifty thousand
abitants, are being applied to the same town grown to two hundred
l fifty thousand. To allow to perish by sanatory neglect is just the
e as to take so many persons out of their homes, and forcibly put
m to death; and yet, if this were done, the whole world would revolt
the barbarous act. Still, in how many instances do our local author-
s calmly look on, while poor and innocent victims are condemned to
athe a poisoned atmosphere, or drink poisoned water, which is a great
me in the eyes of humanity. In view of the fact that this terrible
tinuing tax on human life, and all this needless suffering, fall with
mense over-proportion upon the most helpless classes of society—
on the poor, the ignorant, the immature; upon classes which, because
their dependent position, cannot utter their indignant protest against
miseries thus permitted to be brought upon them—they have, from
se circumstances, the strongest of all claims on a Legislature which
justly measure and can abate their grievances.

A LEGISLATIVE COMMITTEE ON PUBLIC HEALTH.

Our Legislature always has various committees, consisting of men
lected for their special intelligence, to watch over the several classes
public interest and see that they suffer no damage; and more than
is, to see that they derive the most benefit from the wisdom, care, and
wer of the Government. There are Committees on Education, Agri-
lture, Manufactures, Insurance, Finance, Fisheries, Railroads, Mer-
ntile Affairs, Hospitals, Asylums, and other matters of public interest.
e Legislature of New York adds to these a Committee on Public
ealth. I would, therefore, respectfully suggest to your Excellency to
commend the raising of a joint committee of the Senate and Assem-

bly, to act in concert with the State Board of Health, in so mod
the laws relating to public hygiene that they may have their bas
potency in the well recognized principle: "*Salus populi suprema es*
In as far as human life is more important than all financial int
and even in the financial view the creative power of human fo
more valuable than all created capital, the interests of the people s
take precedence of all other provisions. Every law, grant, or pri
from the Legislature should have this invariable condition, that h
health should in no manner or degree be impaired or vitiated ther

When the Legislature grants the right to dig a canal or ditch,
build a dam for reservoirs to flow the land or irrigate, the gran
properly held responsible for all the damage that may be caused th
to other lands, crops, or mills. This is right and proper; but b
this, the grantee should be held responsible that no damage sha
caused to human life by the changes in the condition of the w
This cannot be compensated by money.

In all cases where life and health are in question, the arm of the
ernment should be used with sufficient force to protect them. W
person tampers with human life by adulterating food, or know
offers to sell unwholesome articles of diet; when he adulterates
with water, or other foreign matter, and thus deprives children
adults of their due nourishment, or impairs their stomachs with
gestible mixtures; when men thus selfishly jeopardize the health
sacrifice the lives of others for their own gain, the law should reco
this as a crime, and hold the offense amenable to the same punish
as robbery or manslaughter. Nor should it relax its stringency
the people are assured of safety whenever they purchase milk or
articles of diet.

I am aware how fully the laws represent the feelings and opinio
the people, and that, if the law is inefficient or unacted upon, it a
from a want of knowledge on the part of the people themselves.
only does this ignorance tell upon the Legislature, but even if it
possible for the Legislature to provide all the conditions of a hea
existence, this object could not be obtained unless the people were
ciently instructed to avail themselves of the rights thus conferred
them. It would be in vain for the Legislature to enact a plan
which houses shall be built to insure ventilation, unless the inhabit
of those houses understand the worth of fresh air. In vain would
to bring an abundant supply of fresh water to our doors, if in our i
rance and indolence we refuse to use it. There must be intellig
both in the legislator and those for whom he legislates, if we are to
advantage of our present knowledge of the laws of life to secure us
disease and death. Such being the general ignorance, to post
State action until the people become educated would be to neglect
State's noblest function, and to consign its inhabitants meanwhil
very great dangers.

LEGISLATION AGAINST QUACKERY.

There is one terrible evil, however, with which the profession of m
cine has long had to cope, and against which I would now specially
legislative action, inasmuch as the people appear ripe for the movem
I allude to the unrestricted quackery which now sits like a vam
upon the body politic, and which is never satisfied until the last dro
the blood of its victim is exhausted. To no body of scientific obser

the effects of mal-administration of medicine made more painfully
ifest than to medical men; but who, unfortunately, have always
ed themselves in a wrong position whenever they have attempted
ave laws enacted to protect the people against it.
he difficulty has arisen from a want of understanding, on the part
he community, that such laws are intended for their protection, and
for the profession. So long as the community were not disposed to
perly interpret our intentions, there was nothing else to be done but
wait until they were sufficiently educated to appreciate our motives.
Practically speaking, I believe the time has come when there will be
difficulty in having suitable laws passed, inasmuch as the people
mselves are already drawing the line between quackery and legiti-
te medicine, and will take the proper steps to punish any offenders.
der this conviction, I have, as Chairman of a Committee on State
dicine and Public Hygiene, appointed by our State Medical Society,
pared the draft of an Act for presentation to our Legislature, look-
to the protection of the sanitary interests of the people against
ud and imposture in the practice of medicine. This bill, after receiv-
the indorsement of the State Medical Society, has been submitted
the revision of a special committee, appointed for the purpose, and
ll be found in the pages of this document, together with the report of
e Committee on State Medicine and Public Hygiene.

THE WORK OF THE BOARD.

In accordance with the plan of duties adopted by the Board, infor-
ation and advice connected with public hygiene have been prepared
d disseminated, from time to time, otherwise than through our bien-
al reports. Lectures have been delivered, particularly in our univer-
y, and in some of our seminaries and schools, calculated to educate
e rising generation to a due appreciation of the laws of health.
The daily press has rendered much good aid in giving publicity to our
structions as to preventive measures against scarlatina, small-pox,
alarial fevers, and other preventable diseases; likewise in calling
tention to our recommendations relating to draining and filling in of
w, swampy places; and also in fostering the cultivation of grasses
d trees, especially of the eucalyptus species. These publications,
though fragmentary and unofficial, have done much to spread the
nowledge of hygienic principles, by chronicling successful results, and
showing up, in its true light, the sanitary condition of various local-
ies; in giving warning of surrounding danger; in advising as to the
eps to be taken; generally, in the elucidation of truth and eradication
error; and, finally, in the encouragement invariably imparted to the
lvancement and prosecution of sanitary science.

Besides the means already mentioned for carrying out the object of
he Board, an extensive correspondence has been continuously kept up
ith the medical men scattered in all directions over the wide area of the
tate, who, as a rule, have acted like true philanthropists, in generally
esponding promptly to all questions relating to sickness and disease.
The names of most of these voluntary coöperators will be found in
onnection with the mortality reports, from some forty cities and
owns, published monthly in the "Pacific Medical and Surgical Jour-
al," and the "Western Lancet," of San Francisco, abstracts from
which will be found in this report. The true sanitary condition of the
State is thus ascertained from reliable sources, and the results made

known in an authoritative manner, for the benefit both of the p sion and the community, together with such remarks relating to vailing diseases as the state of the case seems at the time to requi

The regular meetings of the Board have been much occupied the discussion of the information derived from these mortality re and several important subjects connected therewith, that have not been published otherwise, have received attention through paper reports of the meetings. Furthermore, for the more com fulfillment of all the purposes for which the State Board of Health created, the different members have charged themselves with the i tigation of special questions germane to the functions of their the character and scope of which will be learned from the titles synopsis of their contents, and to which, now published in the they were read and considered, I most respectfully beg leave to attention.

VITAL STATISTICS.

The peremptory requirements of the Board, immediately afte initiatory organization, devolved upon me, as its executive officer necessity of devising some general plan in accordance with the met that the principles of sanitary science have already established, for purpose of determining the real condition of the State as regards relative fecundity and mortality of her population, the causes of d within her borders, and the weight with which each cause of d presses upon different portions of the community, whether those tions be considered in relation to age, sex, or condition of her peopl in relation to different sections of her territory.

To meet the emergency, I gratuitously assumed the additional du of the office of Registrar of Births, Marriages, and Deaths—an o altogether extraneous to that which I hold (Permanent Secretary of Board), and which, as is well known, is confided in our sister State a distinct and separate bureau.

These additional duties have involved an extraordinary amoun correspondence and travel, which has kept me continually occupie the discharge of the self-imposed functions of two distinct offices, ei of which exacts, for its proper execution, constant and unremittent plication. Onerous, however, as these duties have been, they would regarded matters of gratulation, had the results been such as were pected to be accomplished. As it has turned out, the law, altho simple and apparently easy of execution, has not been generally c plied with, in consequence chiefly of some intrinsic defects in its fram and the resulting misunderstandings that have arisen respecting details and workings. Accordingly the returns that have been recei from such counties as have complied with its conditions, are too inc plete to be made available for the purposes for which they were signed. This is only what might have been expected, and which been the experience of every nation and State in the inauguration such registration.

"In its practical application to communities, sanitary science in t as in every other particular, has the same difficulties to overcome h as it has encountered everywhere. Restrictions in long establis habits of life and business are submitted to slowly and with much rel tance. Personal convenience rises in antagonism to the principle wh requires each member of society to yield something of individual co fort for the general good. The people require to be educated to s

ssity, and the importance of the sacrifice of their own convenience ersonal interest. They are to learn that the record proof of the , marriage, or death of any person, or of all persons, may become reat importance from a legal standpoint; that the statistics derived efrom furnish a sure index to the prosperity of the State in the ber of births and marriages; that they supply data upon which ernments, communities, and life insurancers may base their action; that they furnish knowledge of unfavorable locations and conditions, ch, when known, may be avoided, and the struggle for life thereby dered easier and more certain of success."

ad the last Legislature approved the amendments of the public lth laws suggested in our second biennial report, from which the ve extract is made, we would, perhaps, now be deriving the benefits rein enumerated; or, at all events, we would have learned something e as to the working of the machinery of the registration laws— defects of which, it was contemplated, would thus, in some degree least, be remedied. Owing, however, to the indifference manifested ards the great social questions involved in these laws, their execu- h has become so nugatory, that I despair of ever making them avail- e for statistical purposes, in their present shape. I would, therefore, pectfully recommend, after the renewed experience I have had of ir practical operation, during the last two years, that they be placed, in other States, under the special management of the Secretary of te. Their proper administration exacts more authoritative pow- than are possessed by the State Board of Health, involving an penditure for clerical labors, and the furnishing of blank books and ms of returns, with proper rulings and headings, to County Clerks d others, not otherwise provided for. The lack of provision for car- ing into effect the law in these latter respects, was probably the incipal reason why it has not been more generally obeyed.

It will be observed, notwithstanding, that pursuing the plan adopted our preceding biennial reports, I have been enabled to present the ortality statistics derived from the continuous reports of numerous ies and towns, situated in every section of the State, and embracing out half the total population. These results, together with those tained from the reports of the various hospitals and public charitable stitutions in the State, show a very favorable sanatory condition, and ill be found under their appropriate headings.

IRRIGATION.

This subject, of such momentous import to the industrial interests of e State, has not failed to receive the special consideration to which it entitled from a sanatory point of view. In another part of this report, the paper under the head of Malarial Fevers and Consumption, the ct will be found well established that the spreading of water over the urface bears a strong causative relation to malaria. This is proven ot only by the history of irrigation thus far in our own State and else- here in the development of diseases attributed to malaria; but, also, *converso*, by the disappearance of the effects of the latter, when over- owed marsh and swamp lands are properly drained and cultivated. uch favorable results are partly due to the systematic removal of the

surface water, and partly to the absorption of the decomposing or matter by the growing crops. On the same principle, Maury succe in modifying, if not in preventing the malignant fevers that origi in the marshes surrounding the observatory at Washington, b extensive planting of the *helianthus*, or sunflower, which possess uncommonly great absorbing power.

To the influence of a large flowering aquatic plant (*Jussieua gr flora*), Cartwright ascribed the immunity from fevers of the bayous lagoons in lower Louisiana; and Sebastian recommends, for similar sons, the culture of the calamus (*acorus calamus aromaticus*). For same purpose, we have, particularly on account of its rapid growth, the balsamic exhalation of its etherial oil, suggested and encourag general planting of the *eucalyptus globulus*.

By such means, in conjunction with systematic and thrifty cultur the soil, and the careful handling of all products, it is confide expected, that we will not only be enabled to ward off disease, but to enhance the salubrity of certain localities now regarded as n riously unhealthy. Everything, however, depends upon the judgm and skill exercised by the engineers, who must design, plan, and exe the necessary works. After a thorough reconnaissance shall have b made, and a knowledge of the experience of other countries practic applied, a comprehensive system of irrigation may be intelligently ried out, and the great valley divided into those natural districts wh its topographical features might be found to require for the attainm of all the ends contemplated, in conformity with the well defined l of sanatory science. To the map, demonstrative of some of the m features of a projected system of irrigation, as well as the rang malarial diseases, in connection with temperature, I would respectfu refer for further information on this subject.

SEWERAGE AND DRAINAGE.

There is no subject within the scope of our official duties which m be regarded as of more vital importance than that of sewerage a drainage. Upon the character and perfection of the appliances wit our cities and towns for the removal of decomposing matter, the s cess of all sanitary efforts is more dependent than upon salubrity insalubrity of climate.

For example, Paris and Brussels, which have climates more sa brious than that of London, have nevertheless a higher rate of m tality than the latter, proving conclusively that the sanitary works London are of a more effectual, and therefore of a more perfect ch acter, and that they better fulfill their mission, than those either Brussels or Paris.

Notwithstanding the teachings of history, showing on the one ha that the frightful pestilences of the middle ages were owing to t saturation of the ground and pollution of the streams with filth, and the other, that to the drainage of ancient Rome, which was arrang upon principles deduced from the most profound study of mathemati and hydraulics, may be attributed the success with which the inha itants of the Imperial City preserved social order throughout so den and vast a mass of human beings, it is only within forty years of o present civilization that the abominable cesspool system began to superseded by the sewerage system.

Before the present century vast quantities of filth were allowed

umulate in tanks or pits, termed *cesspools*, in the best ordered cities the world; and whenever the amount of refuse exceeded certain its it was removed by manual or horse labor, and thrown into the ers. It can easily be imagined what a bad effect these accumula- ns of putrifying animal and vegetable matters must have produced on the health of the inhabitants of cities. They poisoned the atmos- ere with fœted emanations, whilst the overflow or leakage of the uid contents furnished abundant contributions to the wells. There be no question as to the great superiority of the sewerage system against the cesspool plan; for in every town, where it has been opted, the public health has been greatly improved. The medical icer of the Privy Council of England, in one of his late annual ports, gives a list of twenty-four English towns in which, owing to e adoption of the present sewerage system and the improvement of e water supplies, the death-rate has been diminished from five to ty per cent. The sewerage system was found, however, to be open one great objection: it converted a large number of rivers into re sewers, and greatly injured the riparian fisheries Owing to the ormous amount of filth discharged into the Thames, and similarly uated rivers, their waters in many places became simply diluted wage, from which noxious exhalations were constantly evolving. he same effects are experienced from the drains opening above the w tidal edge at San Francisco. The mouths of these sewers should trapped; for wind and the rising tide readily force back their con- nts, which are very fœtid, especially as salt water promotes the composition of sewage.

The pollution of rivers by town sewage has become a gigantic evil. ttempts—always unsuccessful—have been made to deprive sewage of s solid ingredients before it passed into the rivers. Disinfectants have een employed, and with greater success. I am, however, of opinion hat in dealing with sewage pollution, preventive measures alone will rove efficacious. The drainage of towns should not be permitted to ervert the pure waters of our rivers into foul and lethal streams. (1)

In London this principle is now recognized and put into practice. he sewage of a large portion of the city is conveyed in close sewers to any miles below, where it is applied to the purpose of fertilizing the oil. The earth, and not the water, is the natural destination of the *ectæ* of the population; and to use the words of Liebig: "If clearly nderstood and properly managed, the employment of sewage will prove blessing to agriculture; and those who, by unwearied perseverance, ave at last seen the consummation of their labors, may justly be looked pon as the benefactors of their fellow men."

London is the best sewered large city in the world, and the excellence f its provisions for thorough drainage, which is one of the causes of s comparatively low death-rate, renders it a model city in this respect.

The California State Board of Health consider themselves, therefore,

(1) I cannot here refrain from calling attention to a recent instance of possible "pollu- ion of rivers" in California. In the construction of the new Branch State Prison at olsom, provision has been made for the discharge of the entire sewage into the American River. As the fall in this river is very rapid, more like that of a mountain torrent, and uring the greater part of the time the river dwindles into a very insignificant stream, here is great danger of the water supply in Sacramento becoming poisoned, especially uring the dry season. It is to be hoped that the proper authorities will see to it, that the upply-pipe of the waterworks be carried up beyond Bannon's Slough, where the Ameri- can now debouches into the Sacramento River.

fortunate in having secured the services of one of their member while on a visit to Europe, whose personal exertions enabled through the proper authorities, to have access to the Engineer's De ment of the Metropolitan Board of Works. In another part of report will be found an abstract of the main features of the systen sewerage adopted in London and Paris, illustrated by drawings, co from the original drafts and plans, and from which it is hoped n valuable suggestions may be derived, in the modification of lar systems for the benefit of our own cities and towns. The art though condensed, covers the whole ground, and embodies the germ mechanical principles deduced from centuries of experience, and which every error has been eliminated. At the commencement of reconstruction of the sewers of London, much trouble was met and an experience passed through which our American cities sooner or later undergo. After a long series of observation and exp mentation with fluids of different densities and of various ingredie in which floats of diverse materials were employed, the water-carri system was finally adopted. This, it would seem, is the best adapte the varied requirements of a city population for effecting the spe removal of the principal matter liable to decomposition. It will als found equal to any other system in securing the material elements have to be utilized; but it should not be overlooked that other syst are applicable, and may be adopted with manifold advantage when cumstances are such as to debar the entire use of water-carri Earth and other materials of this character have from time to time b recommended and used, more with a view to deodorize and fix the ments of decomposition, so as to render the matter to be dealt with baneful in its effects on health when accumulating in towns, and als a means of securing its manurial value. In another part of this rep will be found a valuable paper containing all that is essential to known for present purposes respecting the dry earth method of treat refuse.

Recently a new system—the pneumatic, proposed by Captain Char T. Liernur, Military and Civil Engineer, who has had practice in en neering on both sides of the Atlantic—is being brought into use Holland and Austria, and it appears is likely to work very satisfactor The pneumatic system "proposes to draw off fecal matters and the luted air by pipes connected with steam-worked air pumps. Th pumps are attached to air-tight reservoirs beneath ground, in which exhaustion, about three-fourths vacuum is constantly maintained. Fr these large tanks pipes are laid along the principal streets, and at int vals smaller street tanks are placed, communicating by small, short c duits (or pipes, with a sort of valve in each), with the closets in ea house. By partial exhaustion of the air in each of these receptac for the sewer gas and effete matter, without the aid of water to flu the closets, the gas is drawn off from the house pipes, and lodged in t main reservoirs, where it is finally disposed of without detriment to t public health." By the use of stop cocks, this process is also effecti in removing the excreta deposited in the house-drains. No water required for flushing the pipes, and it is said, by the use of one four of the water now commonly employed, the pneumatic system will

(1) Dr. L. C. Lane, whose place in the State Board of Health is now filled by James Murphy.

entire work, and in a much more perfect manner than is possible the water-carriage system alone.

e City of Hague, "after having submitted Captain Liernur's plan committee of professional inquiry, resolved at once to give it a fair, tical trial at the public expense." Here, every night a steam engine es to the reservoirs, a vacuum is created in each by an air pump, the contents of the house pipes are shot into the reservoirs. When servoir has relieved all the houses connected with it, its own con- s, solid, liquid, and gaseous, are pumped by steam into a tender ched to the engine. As fast as these tenders are filled, they are warded to the railroad, and their contents are discharged into air- t casks, for transportation to the farmers. Thus, every night the re city is relieved of its excreta, without disturbance of or annoy- e to the inhabitants.

he pneumatic system was tested at the Vienna Exhibition last year, g attached to a part of the exhibition building, and was found to satisfactorily. It was there inspected by the Emperor William, who ifested his appreciation of the great value of the process by bestow- upon its inventor the Order of Knighthood. It has been indorsed, ppears, by the International Medical Congress of Vienna, who are vinced, from experiments made in their presence, that "the entire em is capable of doing its work completely." In Amsterdam and den it has been practically applied to the districts of the poorer ses, whose ranks had been yearly decimated by the poisonous sewer es incident to the water-carriage system. It has also been intro- ed most successfully into the Government buildings at Prague, while as been applied to districts in that city, by a private company, upon sole condition that the company shall have the sewage matter.

ne great advantage which this system appears to possess is that of olute independence of the care of householders and servants; doing work in spite of negligence or interference. If the system proves e as perfect as its advocates claim that it is, it certainly ought soon rywhere to take the place of the water-carriage system.

or these reasons, we have devoted a large space in our report to the t complete and authentic account of this system, published in the nitary Record," of London. It is worthy of the most attentive sideration of our municipal authorities.

THE INSANE AND INEBRIATE—PROBATIONARY ASYLUMS, ETC.

he proposition to establish probationary asylums for the care of the ane in cases of incipient or suspected insanity, and also a Refuge for Inebriate, is well worthy the attention of our legislators.

Nephalism, the term now used in Europe to designate the temperance vement, is rapidly gaining votaries in all parts of the civilized world, oppose the degeneration of the human race, with all its hereditary ults; and the curative recourse suggested, by the establishment of obationary asylums, commends itself as one of the most efficient and mane expedients which the friends of temperance can encourage. If riety is temporary insanity, let it be treated as such without having ourse to the dungeon cells of a city prison.

In this connection I would call attention to the communications, to be nd in this report, from Dr. G. A. Shurtleff, Superintendent of the ckton Asylum, and Dr. Edwin Bentley, Superintendent of the Napa ylum, in response to certain inquiries as to the prevalence of insanity

at the present time in California, and the condition of the respec
asylums in their charge. While it is very satisfactory to learn
speedy relief is about being afforded to the dangerously crowded s
of the former institution, I would, at the same time, urge the neces
for making ample provision for the earliest possible completion of
entire new structure. As suggested in my former reports, more l
should be purchased in the immediate surroundings for lawns and
den walks; and especially should that portion of the tract encompas
the source of the mountain brook, on which the water supply is h
after to depend, be permanently secured.

CLIMATOLOGY AND CONSUMPTION.

The first step in establishing a medical climatology involves a m
terly acquaintance with all the meteorological agencies which influe
the animal organization, as well as those which make up climate.
our extensive State we have all the known conditions of climate, b
meteorological and medical, and in this vast range, it is confiden
believed, will be found the conditions most favorable to the recov
from all forms of disease. These, however, can be found only by pati
plodding work with the thermometer, psychrometer, wind-vane, r
gauge, etc. For this purpose an army of observers is needed, while
have only here and there a solitary sentinel. As a partial contribut
to these desirable results some of the leading features of the climate
Sacramento and San Francisco—representative points of the inter
and coast regions—derived from a long series of observation, will
found elsewhere under the above caption. Some general results, a
will be found in the isothermal lines on the map illustrative of the a
cle on malarial fevers and irrigation. The subject is of great imp
tance, partly for the reason that we do not yet understand the vari
ways in which climatic conditions and changes cause sickness and dea
although we do know that such is the fact; many fatal diseases prev
ing at certain warm and dry seasons, and certain others during sev
cold and wet seasons. Perhaps, to borrow the metaphor of an affilia
Board, (1) it may not be thought wild enthusiasm to hope that the ti
may yet come "When the chief signal officer of the public hea
department shall be able to make some such announcement as t
'because of the extreme dryness and coldness of the atmosphere,
who expose themselves unduly thereto, and who do not provide agai
the danger by artificial moisture, as well as heat in their rooms, are
this time in danger from inflammation of the lungs and from croup;'
'because of the great warmth and moisture of the atmosphere there
now great danger to children from diarrheal diseases, especially in cit
and places where there is not an abundance of pure fresh air.' Wa
ing signals might well be published concerning dangers to life a
health through numerous other means than shipwreck, and throu
many others connected with meteorology. And this is only possi
through the use of long series of accurately recorded observations."

CONTINGENT EXPENSES OF THE BOARD.

It will be seen that the expenses of the Board have fallen within t

(1) Second Annual Report of the State Board of Health of Michigan.

prescribed by the State. It is the intention of the Board so to
ge the means at their disposal that similar results may always
d, while, at the same time, they will earnestly endeavor to make
investigations and reports as valuable as circumstances will
it.

nty-four months rent of office, to date	$1,200 00
essages and postages (for two years)	145 00
eling expenses of Secretary (for two years)	448 40
for drawings of plans and maps	150 00
eling expenses of Henry Gibbons	280 00
eling expenses of A. B. Stout	280 00
eling expenses of Luke Robinson	120 00
eling expenses of F. Walton Todd	108 00
eling and other expenses of L. C. Lane	96 80
Total	$2,828 20

espectfully submitted, in behalf of the California State Board of
lth.

THOS. M. LOGAN, M. D.,
Permanent Secretary.

ACRAMENTO, July 1st, 1875.

REPORT

OF THE

PERMANENT SECRETARY OF THE BOARD.

3—(4)

REPORT

OF THE

PERMANENT SECRETARY OF THE BOARD.

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he State Board of Health:

ENTLEMEN: In accordance with our organic law and my duties as r executive officer, I beg leave to offer, for your acceptance and pre-ation to the State Legislature, the accompanying report. You will eive, in that portion addressed to the Governor, that I have already rred to some of the leading topics which have occupied our time deliberations, calling special attention to such questions as, in our ion, required legislative action. Working as we do for the pub-and writing, not for the professional, but lay reader, I now pro-e to give the results, rather than the details, of our labors, under ropriate headings or groups, in as simple and perspicuous a manner ossible; and afterward to arrange, in the order in which they were d, discussed, and amended at the several meetings, the papers, em-ying the investigations and studies of the committees and individual nbers of the Board.

ll of which, it is hoped, will meet your approbation.

THOMAS M. LOGAN,
Permanent Secretary California State Board of Health.

SACRAMENTO, July 1st, 1875.

VITAL STATISTICS.

In the last biennial report, certain suggestions were made, po
out how the laws relating to the registration of marriages, birth
deaths might be so amended as to make provision, by compulsory
for more complete statistics, than it is found possible, to collect
existing circumstances. In accordance with these suggestions, so
the friends of progress in this matter drew up a bill for the amend
of the law, which received the approval of the Hospital Commit
the Senate, to which it was referred, but for lack of time it fail
become a law. The reasons why the law should be amended
stronger and more cogent now than ever, because the returns have
becoming more and more irregular and imperfect, and are, ther
utterly worthless for the purposes of statistical compilation and di
sion. As stated in my report to the Governor, society at large h
interest in these statistics over and above the personal interest o
few who record them, and the State should pay for their collec
Certainly no expense for recording them should be borne by pe
placing them upon record. As the law now stands, "the Secreta
the State Board of Health shall prepare and furnish to the Clerks o
several Boards of Supervisors of each county, a model for blank fo
of suitable quality and size, to be used as books of records;" bu
provision is made as to how these books shall be paid for, nor is
Secretary authorized to have them printed. This is, perhaps, the
cipal reason why the law has become inoperative. Some of the Co
Clerks have provided themselves with suitable books, and make pro
returns, but the law does not make distinct provision therefor. F
the experience we have had, it would seem that the clerical work o
elaborate a kind as that involved in the registration of marriages, bi
and deaths, requiring compilation from the original returns and
necessary computations, should be committed to the Secretary of St
who is charged, ex officio, with the duty of supplying stationery, bo
printed matter, etc., for State purposes; while that part of the surv
lance and tabulation which exacts a certain amount of technical kno
edge to make them valuable, might remain under the control of
Secretary of the State Board of Health. This is the plan adopte
other States, where registration laws are now being carried out w
better success, after many years of abortive efforts and trials.

It is to be hoped that no longer time will be consumed in attempt
to carry out the present defective plan The sooner a different s
tem is inaugurated the better, for it must be borne in mind that
main value of such statistics is not in their immediate application
business affairs for a few days, weeks, or months only, but in those g
eral principles which are only reached through long series of obser
tions, extending through many years; and then it depends upon th
accuracy, which is better secured by prolonged than by hasty lab
Life tables are of great pecuniary importance to the people, inasmu
as the life insurance business is based upon them; but no life insura
company would trust or venture their capital on the mortality-ex

of a single year in a single locality; and what is true in this par-
r of this one item of vital statistics, is true of other items.
means of the commendable coöperation of the members of the
al profession in various parts of the State, I am now enabled to
ement, for such as it was expected would be furnished through the
mentality of the registration laws, the following

MORTUARY AND SANITARY STATISTICS.

rsuing the plan adopted in our former reports, I have prepared
r tables for the calendar year eighteen hundred and seventy-four,
ing, as completely as it is possible to do under existing circum-
es, the death-rate in twenty-three towns and localities in different
ns of the State. The population of these places has been put
, for the most part, in accordance with the estimate of the medical
emen (1) furnishing the monthly returns of mortality, and who are
able to judge as to the increase or decrease of the inhabitants
n the area of their practice. By means of these monthly returns,
h have been received continuously for a number of years, we are
shed with the various data that are required for making the present
ts comparable with those of our former reports.
fortunately, owing to the difficulties which attend a correct diag-
, such as the less definite employment of nosological nomenclature,
h allows many deaths to be credited to the wrong disease, and the
eful fact that the most ignorant non-professional persons are per-
ed to give a certificate of death, but little reliance can be placed on
statistics as to special diseases. They may be trusted, neverthe-
in regard to total mortality, and to such particular diseases as
umption, diseases of the lungs, and of the stomach and bowels,
latina, diptheria, and typho-malarial fevers, which are popularly
known, and to which I have chiefly confined my investigation. My
ent purpose is only to show, in as condensed a form as possible, by
ns of tables, a few of the practical facts investigated in such re-
ches, such as the death-rate, as well as the total mortality from all
es, and from certain principal diseases, severally and in groups,
the proportion of deaths from all causes and to population—*i. e.*,
prevalency and fatality of certain diseases.

The names of these gentlemen will be seen in Table No. 1, in connection with the
ts of their labors. I would here, also, take occasion to acknowledge the receipt of
er returns of monthly mortality, as well as of sickness, from the following named
ibutors, with their places of residence, viz: Dr. A. Trafton, *Woodbridge;* Dr. Q. C.
h, *Cloverdale;* Dr. A. H. Cochrane, *Watsonville;* Dr. J. J. Sawyer, *Susanville;*
Dr. Thos. Ross, *Wood-*
M. C. Parkison, *Antioch;* Dr. E. Parramore, *Yolo County;* Dr. H. F. Hall, *Modoc County;* Dr. J. P.
; Dr. G. A. René, *San Bernardino;* Dr. M. S. McMahan, *San Jose;* Dr. C. G. Kittredge,
son, *Stanislaus County;* Dr. C. B. Robertson, *San Andreas;* Dr. M.
and; Dr. J. H. Crane, *Petaluma;* Dr. W. W. Davies, *Salinas;* Dr. W. L. Graves, *Centreville;*
r, *Tulare County;* Dr. J. Bradford Cox, *Healdsburg;* Dr. L. F. Jones, *Sierra*
W. Nichols, *Pajaro;* Dr. J. S. Hammond, *Lockford;* Dr. P. B. M.
; Dr. W. B. H. Dodson, *Kelsey;*
er, *Oroville;* and Dr. J. E. Pelham, *Shasta.*
though the reports from these various sources are not available for present purposes—
use of want of continuity with some, and because of being of too recent a date with
rs—still they have proved useful in furnishing the Board with prompt and reliable
mation from so many important points, and will on a future occasion enter into our
putations, provided no interruption is allowed to occur in the regular monthly returns.
reports must cover the twelve consecutive months of the calendar year to fulfill all
purposes for which they are required.

TABLE No. 1.

Showing the total mortality, as well as that by the most prevalent diseases, in twenty-three localities, comprising about half the population of the State, with the ratio of deaths to one thousand of population, from January, eighteen hundred and seventy-four, to January, eighteen hundred and seventy-five; also, the authorities for the data.

Localities.	Population	Total number of deaths	Ratio of deaths per one thousand of population	Prevalent Diseases. Consumption	Other diseases of lungs	Diseases of stomach and bowels	Diptheria	Scarlatina	Typho-malarial fevers	All other diseases and causes of death	Authorities.
San Francisco	200,770	4,044	26.1	556	367	293	42	255	122	2,409	San Francisco Board of Health.
Sacramento	21,000	313	14.9	53	37	19	......	10	15	179	Sacramento Board of Health.
Petaluma	4,514	67	12.6	16	2	4	5	3	3	34	G. W. Graves, M. D.
Dixon and surroundings	6,000	17	2.8	2	2	1	......	......	1	11	A. H. Pratt, M. D.
Stockton	12,000	136	11.3	17	7	11	1	31	9	60	Stockton Board of Health.
Marysville	5,000	118	23.6	16	11	8	......	......	16	67	A. B. Caldwell, M. D.
Placerville	1,562	26	16.6	2	1	......	......	......	3	20	E. A. Kunkler, M. D.
San Diego County	6,000	35	5.8	15	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Napa City	5,000	52	10.4	8	12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Watsonville	2,500	49	11.6	9	4	2	......	......	1	33	C. E. Cleveland, M. D.
Folsom and surroundings	3,000	24	8.0	4	3	3	......	......	3	11	S. Lyons, M. D.
Santa Barbara	5,000	120	24.0	34	3	3	......	2	1	77	C. B. Bates, M. D.
Redwood City	3,000	47	15.6	10	3	5	1	1	1	26	C. A. Kirkpatrick, M. D.
Santa Cruz	3,500	30	8.5	11	2	7	......	......	......	10	C. L. Anderson, M. D.
Suisun and Fairfield	6,000	19	3.1	4	2	2	......	......	......	11	J. F. Pressley, M. D.
Colusa and surroundings	4,000	58	14.5	10	6	5	......	......	9	28	Luke Robinson, M. D.
Downieville	1,500	15	10.0	3	2	2	......	1	......	7	Alemby Jump, M. D.
Siskiyou County	7,902	42	5.3	2	9	8	......	......	3	20	Daniel Ream, M. D.
Totals	340,748	5,888	17.2	842	520	448	57	360	211	3,450	

* Twenty-four stillborn are included in the computation for Oakland, excluding which would reduce the ratio to 12.6. See report of Health Officer.

In Table No. 1 is shown the death-rate in twenty-three pr cities and towns of the State, as well as the total mortality by all in these localities, and the deaths and percentage of deaths by s the most generally prevalent diseases.

The twelve months included in this table, show the ratio of per one thousand of population to be 17.2. In our last biennial for the fiscal year eighteen hundred and seventy one–seventy-two, was the healthiest year ever experienced in California, this rat 17.1; while in our first biennial report for eighteen hundred and sev seventy-one, the ratio was 18.8. Thus it is seen, at a glance, th withstanding the unprecedented immigration during the last two revealed in the rapidly increasing population of most of our town death-rate has been but slightly affected. This is the most remar when we reflect upon the great numbers who now resort to Cali as a sanitarium, in the last stages of consumption, and dying he to the sum of mortality.

In order to arrive at a distinct comprehension of the bearing ures in this table, it must be borne in mind that the limit of perce of deaths, which statisticians agree to be unavoidable, is eleven t thousand. All above this they hold to be preventable, by preca in healthy countries. In rare instances the rate falls below the sary limit, as, for example, in Michigan, where it was as low as eig the thousand. I am not aware, however, that what is termed th essary rate has ever been reached in cities. Mortality is always greater where the population is dense, and in London the sta sought to be obtained is seventeen in one thousand, though, in fact has thus far always been exceeded. In practice, it is generally ceded that city mortality, when under twenty, shows a very hig of health. When varying between twenty and twenty-five, it sh fair standard of health; and when reaching thirty, it shows an ala degree of sickness.

The following Table No. 2 has been compiled for the purpo affording the means of forming a judgment respecting the salubri our three principal cities, when compared with other American c particularly in relation to consumption. It is based chiefly o authority of the Registrar of Vital Statistics, Brooklyn.

TABLE No. 2.

nparative mortality statistics for eighteen hundred and seventy-four.

CITIES.	Population	Total number of deaths.	Per one thousand	Deaths from consumption	Per cent of consumption to total mortality.	Consumption per 1,000 of population
York	1,040,000	28,727	27.62	4,033	14.04	3.88
elphia	775,000	15,238	19.66	2,304	15.12	3.10
lyn	450,000	11,011	24.46	1,267	11.45	2.81
ouis	450,000	6,506	14.45	581	8.93	1.29
go	395,000	8,025	20.29	630	7.85	1.62
n	375,000	7,812	30.83	1,309	16.75	3.46
ore	350,000	7,401	21.14	1,036	14.00	2.96
nati	260,000	5,321	20.46	....	....	....
Orleans	207,000	6,798	32.76	....	....	....
Francisco	200,770	4,044	20.14	556	13.75	2.77
ington	150,000	2,959	19.72	471	15.90	3.14
land	145,000	2,195	15.13	178	8.10	1.23
urg	137,000	3,381	24.68	331	9.78	2.41
ukee	100,000	1,909	19.09	136	7.12	1.36
dence	99,608	1,983	19.90	269	13.58	2.70
ster	80,000	1,405	17.56	188	13.38	3.10
ond	65,000	1,591	24.47	231	14.52	3.55
Haven	59,000	1,073	17.85	197	18.35	2.96
eston	50,000	1,948	38.96	98	5.05	1.96
his	50,000	1,148	22.96	137	11.93	2.74
River	43,000	1,177	27.21	148	12.55	3.41
n	34,000	479	14.09	68	14.19	2.00
ston	34,000	626	18.41	16	.25	....
a	30,000	338	11.16	32	9.46	1.06
mento	21,000	313	14.90	53	16.93	2.52
nd	20,000	278	12.65	25	8.99	1.25

e plan of giving the mortality rates for a series of years, affords a more correct means of comparison than can be obtained by ination of the rates of a single year.

e following table, Number 3, is extracted for this purpose from eport of the Health Officer of San Francisco. The rates for eigh- hundred and seventy-four being added, so far as they have come to .

this means it is readily seen that a serious epidemic affecting some one year and others the next, would, were one year the basis of ment, cause unjust discrimination.

his is particularly noticeable in New Orleans and St. Louis. In the named city the rate was 54.3 in eighteen hundred and sixty-seven, far less in all the other years; and, in the second, the rate of 46.3 ghteen hundred and sixty-six, was not half as much in any suc- ing year, save eighteen hundred and sixty-seven. A glance through table shows that a uniformly high rate prevails in New York and

New Orleans, and in several of the English towns; while the r
obtains in regard to Philadelphia, San Francisco, St. Louis, Cinc
and also London and Birmingham. The great similarity betwe
average rates in a number of our own cities and those of Great B
affords an interesting feature. While St. Louis carries off the pa
being the healthiest *large* city in the world in the year eighteen hu
and seventy-four, we, nevertheless, see that in eighteen hundre
sixty-six, the rate was 46.3 in one thousand. The percentage i
Francisco and Philadelphia corresponds very closely, and gives
rank as very healthy cities.

Of smaller towns Oakland ranks next to Peoria, where, as se
Table Number 2, the rate was 11.1 in eighteen hundred and se
four. Sacramento ranks next to Oakland.

TABLE NO. 3.

Showing the number of deaths annually per thousand of inhabitants following cities of Europe and America, for a series of years.

UNITED STATES.	1866.	1867.	1868.	1869.	1870.	1871.	1872.	1873.
New York	33.5	32.3	25.4	29.4	29.3	27.5	32.6	27.9
Philadelphia	24.3	19.8	20.6	20.2	22.7	22.6	26.3	20.3
Brooklyn	27.8	27.8	24.4	....	24.1	24.7	30.0	25.2
St. Louis	46.3	30.2	20.6	20.6	21.3	16.8	23.0	....
Chicago	32.2	21.2	23.7	23.2	24.5	21.5	27.6	23.9
Baltimore	....	24.4	....	....	25.9	25.2	25.9	....
Boston	22.8	....	....	23.3	24.3	22.7	30.5	28.4
Cincinnati	34.9	20.1	24.6	18.0	....	21.7	20.5	22.8
New Orleans	....	54.3	27.4	....	36.2	28.0	30.6	35.8
San Francisco	21.0	19.2	25.5	23.3	21.0	17.4	17.5	20.3
Sacramento	19.7	16.0	24.6	26.0	23.2	19.1	19.5	20.1
Oakland	....	....	....	....	....	....	....	14.4
Average, fourteen large cities	....	....	....	....	2.46	24.1	26.6	....
GREAT BRITAIN.								
London	....	....	....	....	24.0	24.7	21.4	22.4
Liverpool	....	....	....	....	31.1	35.1	27.0	25.9
Glasgow	....	....	....	....	29.8	32.9	28.4	....
Manchester	....	....	....	....	27.8	31.2	28.5	30.2
Birmingham	....	....	....	....	21.1	24.9	22.9	24.8
Dublin	....	....	....	....	24.0	26.2	28.9	....
Leeds	....	....	....	....	28.2	26.4	27.8	27.5
Sheffield	....	....	....	....	25.2	28.3	26.0	....
Edinburgh	....	....	....	....	26.3	26.9	26.4	....
Bristol	....	....	....	....	29.9	23.2	22.0	....
Newcastle	....	....	....	....	25.4	32.2	26.3	30.3
Average, twenty-one large towns	....	....	....	....	25.8	26.9	24.3	24.0

Reverting to Table No. 1, we find Stockton taking preceden
Oakland, and even of Petaluma, which, in our last report, presente
lowest death-rate of our smaller towns. Of rural towns, Dixon
a slight precedence of Suisun and Fairfield, which are shown to b
healthiest localities in the State. St. Helena, Siskiyou County, and
Diego County next follow, in the order in which they are respect

ed. The highest death-rates are found in Santa Barbara and Marys-
The mortality by consumption in the former place, as well as the
mortality, is aggravated by extraneous causes—the advent of the
isical and other valetudinarians in search of a more favorable
ate, which invalidate any legitimate deductions as to local salubrity.
so with the latter place, which affords an exemplification of what
been advanced in another part of this report respecting the slow
effect of malaria in the production of phthisis. Our statistics
a high death-rate here, both from malarial fevers and consumption,
ratio per one thousand of population being in both cases 3.2. As is
known, pulmonary affections are often associated with repeated
ks of intermittent fever, followed by malarial cachexia; and in this
we can account for the large ratio of deaths by consumption in
ysville, which is confessedly proclivous to malarial diseases.

assing on from the consideration of the variation in the death-rate
hese different localities, which demonstrates that different causes are
ork, we proceed in the search for these and their preventives, to
mine into the total number of deaths each month, in connection with
race, age, and nativity.

he large disproportion of the sexes is the first feature that strikes
ntion in Table No. 4, there being sixty-four per cent male to thirty-
per cent female decedents among the total deaths. This percentage
not varied materially within the last six years, although formerly
disproportion was much greater, in consequence of the great rush
er of male adventurers without their families. The last United
es census shows that about the same disproportion of deaths in the
s obtains in all the new States and Territories, owing mainly to the
that the males comprise about sixty-two per cent of the population.
, making allowance for this fact, the ratio of deaths for males con-
es too much in excess, and sustains what was advanced in our last
ort, respecting the very natural supposition that, with his more
orous frame and sturdier make, the vitality of the male should be
ter than of the female, his average life longer, his greatest age
ater. That it is not so, however, is a problem which science has not
solved.

This law of population holds good in every country of which we
e any statistics; about five per cent more males than females are
n, but at five years of age more girls are alive than boys. Again, at
ry period of life, the "expectation of life," as insurance companies
n it—that is, the average term yet to live—is greater in women than
men. And, finally, of very old persons, the large majority are
men. So true is this, that the last census of France shows that at
age of ninety years, there were three women to two men, and at
age of one hundred, the number of women was more than sixteen
es the number of men." (1)

With regard to race, the mortality of the black is nearly one and a half
cent, while the black population, according to the United States cen-
is less than one per cent of the whole. This shows the same larger
rtality than that of the whites, which has been observed everywhere,
especially in the Southern States, but which cannot reasonably be
ribed to the influence of race as its chief factor, according to the
ular idea, unless it be maintained that this high comparative death-

) George H. Naphey's Counsels on Nature and Hygiene.

rate is the cause of the Negro's poverty and adverse soci domestic conditions. The white race is no more above the influ bad sanitary conditions than the Negro, and exhibits an equall death-rate when the necessary consequences of injurious surrou exist. Take, for example, the account of the death registers i York: In eighteen hundred and sixty-eight the deaths in the te houses, and in the hospitals and other charitable institutions (the i of which are mainly derived from the tenement houses), cons 75.79 per cent of the total mortality of the city. In other wor smaller half of the population of New York furnished more tha times as many deaths as the larger half who lived in private dw But while the facts in our possession, and which cannot be sho our tables, can hardly be used to sustain the opinion that the mo of the Negro race is greater here than that of the white, *ceteris p* on account of the mere influence of race, *per se*, they clearly c what has been observed everywhere respecting the relative suscept of the white and colored races to some of the causes of disea death.

Not to be too circumstantial, the greater liability of the especially to pneumonia, and other diseases of the respiratory o and the tubercular diseases in general, appears to be chiefly instru in the production of a large comparative mortality; while, on the hand, the well attested exemption from malarial diseases, diptheri scarlatina, in squaring the account, would leave a very small, balance at all, against the Negro race. The Fauna, Flora, and ra men have been created with different inherent adaptations for eac ticular clime. Transplanted to an uncongenial soil they do not flo but on their native grounds are strong and hardy. This well estab fact presents the reason why the Negro is so proclivous to vari flammatory diseases of the respiratory organs, while he seems to riate on the malaria of his native zone.

The remarks respecting the mortality of the Negro race apply certain degree, also, to the copper-colored races, which include C and Indians. These constitute about ten per cent of the popul while the mortality is 11.3 per cent. This, however, does not rep the real rate, inasmuch as the Chinese decedents are excluded fro computations for some localities. The mortality of the Chine malarial fever was frightful, in the neighborhood of Oroville, duri months of August, September, October, and November, and ye does not appear in the table. In San Francisco, according to the a report of the Health Officer, ending June thirtieth, eighteen hu and seventy-four, the deaths among the American population are to have been at the rate of 19.8 per one thousand, while the C rate was 32.1 per one thousand. But are we thence necessarily to that the Mongolian race is of essentially inferior vital stamina Caucasian; less able, because of race, to resist the causes of di Bad as their sanitary surroundings are in the overcrowded and condition of the quarters which they occupy, we do not find there is as great an excess of mortality in the degraded Chi as we have already seen to exist among the tenement-house popu of New York.

As an offset to the terrible mortality by malarial fever, just al to, among the Chinese near Oroville, Dr. J. Bradford Cox, physici the Hoopa Valley Indian Reservation, in Humboldt County, rep that out of three hundred and one sick Indians treated by him d

rresponding months of September, October, and November, at rmer place, but two died. Not a single one of these, however, case of fever; Humboldt County being almost exempt from al fevers. This fact speaks strongly in favor of the viability of tive Indian race, whose powers of resistance to disease seem to be rdinary, so long as he is not subjected to the habits of civilized ut it is sad to know that all attempts to elevate the moral and ctual condition of the aborigines produce physical deterioration. me observation has been made by Livingston, Du Chaillu, and Sir l Baker, respecting the Negroes of Central Africa. The last authority says he never saw a case of mania nor met with more ne idiot. Africans never commit suicide and never go mad; the n never give birth to cripples or monsters. In his enumeration of es he never mentions tuberculosis or scrofula, but states that small- d dysentery are prevalent and fatal; that typhoid fever, measles, ing cough, scarlet fever, croup, and diptheria are unknown.

hout entering into any further analysis of this division of our table, it, that the white race is thus by comparison demonstrated to have st proportionate mortality, and, consequently, to be the healthiest. hile admitting this prima facie evidence of the superiority of the sian, in reference to resistance to disease, it must be remembered ature is not responsible for our diseases, but that man himself is iginator, and that if he is ever made free from them it will be by ting his own conduct, and bringing it into harmony with the con- s of healthy existence. If the advancement in health and length s in California has resulted from the limited improvements that lready been made in our modes of life, since the American settle- how great are we not warranted in believing the improvement will en our conduct is brought into much closer harmony with sana- aws. In some things pertaining to the preservation of health we ot improved, but rather retrograded. In the means for securing ous supply of pure water; in the number, excellence, and efficiency magnificent sewers of ancient Rome for conveying quickly into ift Tiber all the filth of that vast city; in the number of splendidly ucted public baths in which all were free to wash and be clean, tropolis of our State will bear no comparison whatever.

fornia embraces within her boundaries every physical and climatic ion that is necessary to invigorate and energize the health and ue of her inhabitants. Like her analogue, in Ancient Greece, even the thick air of Bœtia was insufficient to paralyze the men- rgy of a Hesiod, a Corinna, or a Plutarch, and where everything to thrive like seeds sown in a virgin soil—so here, while the ains, like those of Thessaly, shall tutor the shepherd and the in everything that gives prowess in bodily vigor, shall, also, in, bright, elastic air of our plains smile, like that of Attica did he brains and nerves of the Athenian, if we only but practically the knowledge they possessed of a perfect system of hygienic

ther important class of facts derived from this table consists in rtality by months, which we will now discuss in connection with f the special causes of this mortality. It will be observed that:

The greatest number of deaths occurred in October..
The next greatest number of deaths occurred in January.....................................
The next greatest number of deaths occurred in July...
The next greatest number of deaths occurred in December...................................
The next greatest number of deaths occurred in August.......................................
The next greatest number of deaths occurred in March..
The next greatest number of deaths occurred in June..
The next greatest number of deaths occurred in September...................................
The next greatest number of deaths occurred in November....................................
The next greatest number of deaths occurred in May...
The next greatest number of deaths occurred in February.....................................
The least number of deaths occurred in April..

Total for twelve months..

As established in former reports, the greatest mortality was not dent with the highest temperature, but occurred two or three after this period, when the system, exhausted by the prolonged Summer, yields to the pernicious influence of malaria. This is in the Comparative Table No. 5, to which attention is now called proceeding from all causes to the special, we trace, through the pr sion of the months, the fatal march of certain prevalent diseases.

The largest number of deaths caused by any one disease was from consumption; (1) the greatest mortality by this disease being December, and the least (45) in July. For the purposes of comp and in order that the mortality of the three years covered reports may be seen at a glance, the monthly deaths of the p years are placed in the left hand columns of Table No. 5. In the comparison, however, the large increase of the State in pop within the two last years (one hundred and fifty thousand, more o must be kept in mind. As with consumption, we find the greates ber of deaths by other diseases of the lungs (62) occurred in Dec and the least (21) in July. This corroborates what has been st other parts of this report respecting the influence of cold and weather in the causation of those diseases, and on the other ha beneficial effect of a warm, dry atmosphere.

(1) See remarks on this disease in articles on "Malarial Fevers and Consumpti on "Climatology and Consumption."

TABLE No. 5

Comparative table of mortality of certain prevalent diseases, by months.

Months.	1870-71. Consumption	1871-72. Consumption	1874. Consumption	1870-71. Other diseases of lungs	1871-72. Other diseases of lungs	1874. Other diseases of lungs
July	57	47	45	21	13	21
August	63	54	57	24	16	43
September	63	59	64	19	12	35
October	64	64	75	27	37	32
November	64	64	60	33	40	45
December	65	64	93	51	36	62
January	85	68	90	48	20	52
February	59	59	75	51	43	56
March	70	74	81	42	35	56
April	69	73	66	22	38	45
May	55	78	71	23	33	41
June	60	50	65	19	33	32
Totals	774	754	842	380	356	520

Months.	1870-71. Diseases of stomach and bowels	1871-72. Diseases of stomach and bowels	1874. Diseases of stomach and bowels	1870-71. Diptheria	1871-72. Diptheria	1874. Diptheria
July	37	19	80	7	2	2
August	38	25	49	5	2	5
September	29	46	58	5	3	5
October	33	72	36	4	4	8
November	18	13	30	9	6	7
December	22	17	26	6	1	5
January	9	10	20	9	1	7
February	11	18	24	......	1	2
March	12	10	16	2	3	5
April	8	9	15	4	......	8
May	33	31	25	1	12	2
June	30	39	69	1	2	1
Totals	270	309	448	53	37	57

Months.	1870-71. Scarlatina	1871-72. Scarlatina	1874. Scarlatina	1870-71. Typho-malarial fevers	1871-72. Typho-malarial fevers	1874. Typho-malarial fevers
July	4	1	36	18	17	20
August	3	2	26	13	18	30
September	6	1	24	21	24	30
October	15	1	25	34	21	32
November	15	1	19	43	23	18
December	13	4	26	24	21	22
January	15	3	57	30	11	7
February	6	4	23	13	14	13
March	4	3	39	13	18	13
April	4	1	22	7	11	11
May	4	1	37	8	16	5
June	4	2	26	13	10	10
Totals	93	24	360	237	204	211

Months.	1870-71. Total	1871-72. Total	1874. Total
July	144	99	204
August	146	117	210
September	143	145	216
October	167	199	208
November	182	147	179
December	181	148	234
January	196	113	233
February	140	139	193
March	143	143	210
April	114	132	167
May	124	171	181
June	127	136	203
Totals	1,807	1,684	2,438

umber of deaths occurred in October	551
est number of deaths occurred in January	521
est number of deaths occurred in July	509
est number of deaths occurred in December	509
test number of deaths occurred in August	507
test number of deaths occurred in March	500
test number of deaths occurred in June	487
test number of deaths occurred in September	484
test number of deaths occurred in November	482
test number of deaths occurred in May	459
test number of deaths occurred in February	443
ber of deaths occurred in April	436
welve months	5,888

ished in former reports, the greatest mortality was not coincihe highest temperature, but occurred two or three months eriod, when the system, exhausted by the prolonged heat of elds to the pernicious influence of malaria. This is shown parative Table No. 5, to which attention is now called, while from all causes to the special, we trace, through the progresmonths, the fatal march of certain prevalent diseases.

est number of deaths caused by any one disease was (842) mption; [1] the greatest mortality by this disease being (93) in and the least (45) in July. For the purposes of comparison, ler that the mortality of the three years covered by our y be seen at a glance, the monthly deaths of the previous placed in the left hand columns of Table No. 5. In making ison, however, the large increase of the State in population two last years (one hundred and fifty thousand, more or less,) pt in mind. As with consumption, we find the greatest numhs by other diseases of the lungs (62) occurred in December, st (21) in July. This corroborates what has been stated in s of this report respecting the influence of cold and damp the causation of those diseases, and on the other hand, the ffect of a warm, dry atmosphere.

arks on this disease in articles on "Malarial Fevers and Consumption," and ogy and Consumption."

TABLE No. 5.

Comparative table of mortality of certain prevalent diseases, by months.

Months.	1870-71.	1871-72.	1874.	1870-71.	1871-72.	1874.	1870-71.	1871-72.	1874.
	Consumption	Consumption	Consumption	Other diseases of lungs	Other diseases of lungs	Other diseases of lungs	Diseases of stomach and bowels	Diseases of stomach and bowels	Diseases of stomach and bowels
July	57	47	45	21	13	21	37	19	80
August	63	54	57	24	16	43	38	25	49
September	63	59	64	19	12	35	29	46	58
October	64	64	75	27	37	32	33	72	36
November	64	64	60	33	40	45	18	13	30
December	65	64	93	51	36	62	22	17	26
January	85	68	90	48	20	52	9	10	20
February	59	59	75	51	43	56	11	18	24
March	70	74	81	42	35	56	12	10	16
April	69	73	66	22	38	45	8	9	15
May	55	78	71	23	33	41	33	31	25
June	60	50	65	19	33	32	30	39	69
Totals	774	754	842	380	356	520	270	309	448

Months.	1870-71.	1871-72.	1874.	1870-71.	1871-72.	1874.	1870-71.	1871-72.	1874.	1870-71.	1871-72.	1874.
	Diptheria	Diptheria	Diptheria	Scarlatina	Scarlatina	Scarlatina	Typho-malarial fevers	Typho-malarial fevers	Typho-malarial fevers	Total	Total	Total
July	7	2	2	4	1	36	18	17	20	144	99	204
August	5	2	5	3	2	26	13	18	30	146	117	210
September	5	3	5	6	1	24	21	24	30	143	145	216
October	4	4	8	15	1	25	34	21	32	167	199	208
November	9	6	7	15	1	19	43	23	18	182	147	179
December	6	1	5	13	4	26	24	21	22	181	143	234
January	9	1	7	15	3	57	30	11	7	196	113	233
February	......	1	2	6	4	23	13	14	13	140	139	193
March	2	3	5	4	3	39	13	18	13	143	143	210
April	4	......	8	4	1	22	7	11	11	114	132	167
May	1	12	2	4	1	37	8	16	5	124	171	181
June	1	2	1	4	2	26	13	10	10	127	136	203
Totals	53	37	57	93	24	360	237	204	211	1,807	1,684	2,438

From diseases of the stomach and bowels, the greatest number (80) for any one month, recorded in our biennial reports, by diseases of these organs, occurred in July. Thirty-four of these were caused by cholera infantum, in San Francisco. This appears to be an exceptional instance, for the very inconsiderable mortality, heretofore, by this infantile disorder, has been cause for much congratulation. Probably in no large city in the country is there such immunity from this disease. In some cities, as New York and Chicago, the fatality is enormous. By the following statement, prepared by the Health Officer of San Francisco, for the fiscal year terminating with June, eighteen hundred and seventy-four, it appears that San Francisco has the lowest rate. It is remarkable that New York has eight times and Chicago seven times as many deaths, by these diseases, in proportion to population, as San Francisco. Only those under two years of age are included:

Number of deaths to each 10,000 population.	San Francisco, 1873–4, exclusive of Chinese......	New York, 1872..........	Philadelphia, 1873..........	Brooklyn, 1873..........	Chicago, 1873..........	Boston, 1873..........	Cincinnati, 1873..........	New Orleans, 1873..........	Buffalo, 1873..........	Providence, 1873..........	Liverpool, 1872..........	Birmingham, 1873..........
From infantile diarrhea (cholera infantum)....................	5	42	15	25	34	24	9	7	14	11	17	16

Inasmuch as cholera infantum is a Summer disorder, and as San Francisco has no Summer climate, we must look to some accidental circumstances—as either foul air or adulterated milk, or both—as the causes of the unusual mortality by this disease. With pure air and wholesome food, cholera infantum can never prevail in our metropolis as it does in the Eastern cities.

Diptheria and scarlatina have occasionally prevailed since the epidemics of eighteen hundred and sixty and eighteen hundred and sixty-nine—seventy, but generally in a very benign form, as demonstrated by their low death-rate. This remark is especially applicable to the former disease. In June, eighteen hundred and seventy-three, however, the latter disease took a new departure in San Francisco, where, in the following December, it reached its culmination: the deaths amounting to eighty one. In January, eighteen hundred and seventy-four, a rapid diminution to forty-seven deaths took place, and from the subsequent months to the end of the year a remarkable fluctuation in the mortality was observed, when it began permanently to decline. Fortunately, about this time the vacation in the schools came to the aid of this Board, which had advised, but in vain, their closing; for from this juncture the force of the epidemic was stayed. Scarlatina was, nevertheless, by no means confined to San Francisco, but visited, as seen in Table No. 1, Oakland, Los Angeles, Stockton, and other places, with considerable severity. In Sacramento the progress of the disease was very eccentric, occurring so irregularly and at intervals so remote as to suggest the idea of its sporadic character. At the present writing, however—June, eighteen hundred and seventy-five—this scourge of childhood, after exhausting itself in San Francisco and the coast towns, seems to be extending its ravages among our interior towns with great malignancy. The uræmic complication appears to be predominant at present, occurring in connection with every form of development of the eruption, angina, or fever. Whether the eruption be intense or moderate, or imperfectly developed, or entirely absent, or it run a protracted or brief and rapid course, the alarming anasarcous symptoms frequently present themselves, and especially in the latter instance. In its present phase, here, the disease has become a terror to parents. The only reliable preventive lies in absolute isolation.

The remaining special diseases it remains for us to consider, in this connection, have been placed in our table (No. 1) under the general term of typho-malarial fevers. In this class, as stated elsewhere in this report, have been included all the varying forms of those fevers supposed to be dependent on one or the same poison—the different grades described by medical writers, from the simple intermittent to the continued and pernicious, bearing a pretty direct ratio to the intensity of the poison. These diseases proved most fatal (32 deaths) in November, and least fatal (5 deaths) in May, which was the healthiest month in the year. Their percentage of mortality to other diseases occurred in the following localities, in the order in which they are respectively named, as follows: Colusa, 15.5 per cent; Marysville, 13.5; Placerville, 11.5; Napa, 7.7; Oroville, 7.2; Siskiyou, 7.1; Stockton, 6.6; Dixon, 5.9; Sacramento, 4.7; Petaluma, 4.4; Folsom, 4.1; Oakland, 3.9; San Francisco, 3.0; Watsonville, 2.2; Redwood, 2.2; Los Angeles, 2.0; and Santa Barbara, 0.9. In San Diego County, Truckee, St. Helena, Santa Cruz, and Downieville, there were no deaths by these fevers. These facts corroborate what was stated in former reports, that the whole State is more or less subject to malarial diseases. They fail, however, to afford a correct idea of the real state of the case in certain localities. For instance, in Oroville, where the mortality is put down to only 7.2, no account was taken of the mortality among the Chinese portion of the population, which, as already stated, was frightful. "The Chinese," according to Dr. Vance, "are scattered from this place down the Feather River, for three and one half miles—in all about seven thousand—mining, almost entirely with the rocker, and more or less naked, and in the water. A few died in the early part of the Summer, but little attention was attracted until August, when they began to die more frequently. I have been at a cabin wherein there would be fifteen to twenty occupants, and one half of them sick with fever—either intermittent, bilious, or typhoid—all of whom could have been cured by proper treatment. I have prescribed for about two hundred, and of these, my druggist says, five have died. A prominent Chinese merchant has just informed me that the dead amounted to about one hundred. The following is the undertaker's list: Deaths in August, 18; September, 23; October, 30; November, 12; add twenty per cent not reported, and we have a mortality of 100."

Dr. P. B. M. Miller, who has published a very interesting account of this epidemic in the "Pacific Medical and Surgical Journal," for January, eighteen hundred and seventy-five, and which he recognizes as similar to the relapsing fever encountered in Ireland, confirms the statements of Dr. Vance as to the predisposing causes. "We have no conception,"

he writes, "of the amount of filth and destitution common to a Chinese hovel; but when we observe their hovels crowded together, the occupants lying on ground nearly a marsh, without any circulation of air, with broken walls of rough timber, forty or fifty half starved human beings in one apartment, generally on bare mats, sometimes on the earthen floor, which is raised a foot or two above a ditch with stagnant and foul water, it is not to be wondered at, that such an epidemic as the one referred to, should break out. Indeed, the 'China towns' of Oroville and Chico are the most offensive, pestilential, nay, abominable, hot-beds of disease in the State. Each of these towns, more especially in the most densely populated parts, is intersected by streets which can scarcely be traversed by two men abreast, and the gutters are merely irregular furrows in the soil, without any brickwork, and are continually left in a filthy and uncleaned state, emitting the most poisonous effluvia."

I have thus dwelt upon the history of this epidemic among the Chinese because it shows how a mild type of malarial fever like that met with in California, may be converted, under certain circumstances, into a grave disease. Like other continued fevers, the specific cause of relapsing fever is unknown; but we know that it selects its victims from the poor and ill fed, who live in crowded and ill-ventilated apartments, and which conditions have obviously favored its accession, and no doubt also its occurrence in an epidemic form, among the Chinese near Oroville. Thus it is spoken of as the famine fever of the British Isles, and the hunger pest of Germany. Knowing the circumstances under which a grave disease, thought by some to be self-communicable, has been developed, it becomes incumbent on us to learn the lesson which it teaches, and to provide against its recurrence.

"It would be a blessing to every city," writes Dr. Jarvis, of Massachusetts, "and economy to the body politic, to make these conditions a necessary element in the organic law of every prospective city: to require that its whole plan of streets, lanes, courts, and open grounds be made by a sanitary engineer, and be ever afterward under his control. This would prevent the growth of those centers of disease and death, and those condensed hives of feeble population, that now infest the old cities, and cost the municipalities so much to improve. This is legislation in the right direction, and at the right time, where it would be most effectual. It offers to humanity protection against its sanitary foe before it appears, and disarms it of power to do injury."

Reverting to Table No. 4, we find, in the section containing the ages of all the five thousand eight hundred and eighty-eight decedents, that the greatest mortality occurred in the first decenniad of life, and the lowest in the second decenniad. Less than twenty per cent of the decedents were under one year of age; only thirty-two per cent under five years, and about thirty-seven per cent under ten years.

We have already, in our remarks relating to the deaths from diseases of the stomach and bowels, alluded to this comparatively low infantile death-rate as one of the most encouraging and important facts indicative of the salubrity of our climate. Reason for felicitation, in this respect, will be more apparent when we reflect upon the frightful rate of infant mortality all over our country, and especially in our larger Eastern cities, as just referred to in a preceding comparative table of deaths, under two years of age, to each ten thousand population. Excessive heat and improper or tainted food are the casual agents which are accused of taking an active part in the high death-rate of infants in our large Eastern cities. But the Summer temperature,

as shown in our meteorological tables, in San Francisco, is but sixty-one degrees, and only once (in June, eighteen hundred and seventy-four) attained, for a few hours, a maximum of eighty-five degrees. To what cause, then, can we more rationally look for these little graves than to impure air resulting from defective untrapped sewers blowing their foul pestilential vapors through the ill-ventilated houses they were intended to cleanse, or undrained lots or streets made more noxious by the city refuse allowed to accumulate in them? One other possible cause we will barely allude to as quoted from high authority. The unnatural high pressure system under which Americans, and especially Western men, live, can scarcely help showing its exhaustive effects in their offspring. The following suggestive paragraph occurs in the New York *Tribune:*

"The proportion of children among those stricken down by the recent heat was appalling. Yet the heat was not worse than our forefathers bore and lived to tell us of; and it is quite true that the children carried about with them neither exhausting cares in mind, nor too hardly worked bodies, but they had nothing to oppose to the fiery test but flaccid limbs and rasped nerves, bequeathed to them by either liquor-drinking ancestors, or those who make the stimulant of energy and overwork take the place of liquor."

The most healthy period is found in the second decenniad of life, only two hundred and ninety dying between the ages of ten and twenty. Having survived the perils of infancy, the child at this period has fairly entered upon his growth and formation, and at the self-sustaining age of twenty is able to engage in the active duties and responsibilities of life. From this period on to the fiftieth year, or during the next three decades, including the years of labor, exposure, and trial, the largest number died—*i. e.*, two thousand three hundred and eighty-nine, or forty per cent of the total. Having entered on the self-sustaining age at twenty, these persons are supposed to work, or have the chance of working for themselves or the community, until they reach threescore and ten, or to have an offer of fifty working years. But owing to the high-pressure system already alluded to, under which Americans live, the productive life of these two thousand three hundred and eighty-nine decedents was, instead of fifty, only thirty years, and the State lost by their untimely death all the difference between these periods.

After fifty years we find the average ages of the decedents comparing well with those of the healthiest places. It must be remembered, however, that although the average longevity of those who have died is one of the elements in the calculation of the force of mortality, and in the comparison of the health and vitality of different places; yet this must always be taken with much limitation, because the average age at death must bear a relation to the age of the living; and this last differs very widely in different places. A new and growing State like California is filled mostly with adventurers in the prime of life, and has consequently fewer children and aged people than older countries. Therefore, if the proportion of deaths be larger among those in the prime of life, it is for the reason that there are more of these, and less of the young and old to die.

These remarks must not be understood as conveying the idea that more die during the productive ages in California than elsewhere, which is far from being the case; but because such considerations must be applied to all growing cities, towns, and States, when they are compared,

as to their mortality, with other cities, towns, and States that are growing less rapidly, or are stationary.

The last remaining section of our table to be noticed is that under the heading of nativities. Here we find the native and foreign born almost equally balanced, while if we add to the former those born in the Atlantic States, there will remain a difference of about one thousand in favor of the native or American born. It must be remembered, however, that the native element includes the children of native and foreign born as well. The latter are greatly in excess in all our cities and towns, especially in San Francisco; and the Health Officer of this place has compiled from the school census an interesting table bearing on this point. By this we learn that of native children, under seventeen years of age, forty thousand and fifty-six were born of foreign parents, and only twelve thousand two hundred and thirty of native parents, while in five thousand nine hundred and fifty-six the parentage was mixed. Just prior to the close of the year a plan was instituted to ascertain the parentage of deceased minors. The statistics, as yet, are not sufficient to base any comparison upon, but in another year some points of interest may develop:

Number of deaths to each 10,000 inhabitants.	San Francisco, 1873–4 (including Chinese)	New York, 1872	Brooklyn, 1873	Chicago, 1873	Boston, 1873	Cincinnati, 1873	New Orleans, 1873	Buffalo, 1873	Providence, 1873
Of foreign born	92	112	69	76	75	68	95	49	47
Of natives over 5 years	41	52	56	21	90	60	141	29	91
Of natives under 5 years	67	162	127	142	119	100	122	60	81
Totals	200	326	252	239	284	228	358	138	219

Here we see a very great disparity between the different cities. San Francisco, with a low death-rate, has the same number of deaths of foreigners as occur in New Orleans, which has a mortality half as large again; while, on the other hand, New Orleans has over three times as many deaths, relatively, of natives over five years of age. In the absence of statistics of population, however, these comparisons can have very little significance.

To present a more complete showing of all the diseases which have caused the total mortality just discussed, the following statistical tables of the Metropolis and the Capital of California—San Francisco being the type of the coast region, and Sacramento representing the interior valley region—are here superadded.

The tables and remarks for San Francisco have been compiled from the reports of Dr. Henry Gibbons, Jr., the present Health Officer of that city; and the statistics for Sacramento have been abstracted from the records of the City Board of Health.

STATISTICS OF SAN FRANCISCO.

The following table, showing the annual mortality in San Francisco since eighteen hundred and fifty, is reproduced from previous reports. Stillbirths are included up to eighteen hundred and sixty-six–seven:

Year ending June 30, 1851	1,288	Year ending June 30, 1863	2,118
Year ending June 30, 1852	939	Year ending June 30, 1864	
Year ending June 30, 1853	1,619	Year ending June 30, 1865	
Year ending June 30, 1854	1,260	Year ending June 30, 1866	
Year ending June 30, 1855	1,550	Year ending June 30, 1867	2,522
Year ending May 31, 1856	1,226	Year ending June 30, 1868	2,577
Year ending May 31, 1857	1,153	Year ending June 30, 1869	4,093
Year ending May 31, 1858	1,135	Year ending June 30, 1870	3,243
Year ending May 31, 1859	1,254	Year ending June 30, 1871	3,214
Year ending May 31, 1860	1,522	Year ending June 30, 1872	2,998
Year ending May 31, 1861	1,243	Year ending June 30, 1873	3,641
Year ending June 30, 1862	2,051	Year ending June 30, 1874	4,013

Mr. Langley, in the recently issued City Directory, computes the population of San Francisco to be two hundred thousand seven hundred and seventy, which will give a mortality rate equal to about two per cent of the population—a slight increase over the previous year. If, however, we exclude the Chinese (estimated at fourteen thousand five hundred) in this calculation, we have results which may be better appreciated in tabular form, as follows—the facts as to population being derived from the directory and the late school census:

	Population.	Deaths.	Rate per 1,000.
Chinese over 17 years of age	13,214	435	32.9
All others over 17 years of age	127,004	1,943	15.3
Chinese under 17 years of age	1,286	30	23.3
All others under 17 years of age	59,266	1,625	27.4
All others under 5 years of age	21,171	1,310	61.9
All others over 5 years of age	165,099	2,238	13.5
Total Chinese	14,500	465	32.1
All others	186,270	3,548	19.1
Total	200,770	4,013	20.0

TABLE I.

Number of deaths registered during the year eighteen hundred and seventy-four, arranged according to classes, with an enumeration of the more prominent causes, and a statement of the age, sex, and nativity.

Diseases.	Total.	Per cent.	Ages.					Sex.		Nativity.				Total — 1873.
			Under 5 years.	From 5 to 20 years.	From 20 to 50 years.	From 50 to 70 years.	Over 70 years.	Male.	Female.	California.	Other parts of United States.	China.	Other countries.	
1—Zymotic diseases	845	20.9	441	174	186	39	5	444	401	552	97	9	183	908
2—Constitutional diseases	742	18.4	88	57	490	98	9	499	243	123	143	73	400	699
3—Local diseases	1,436	35.5	446	91	582	260	57	937	499	494	233	14	684	1,441
4—Developmental diseases	477	11.8	353	8	50	21	45	236	241	353	42	5	76	430
5—Deaths from violence	206	5.1	17	14	139	31	3	179	27	26	50	12	111	168
Unknown causes. Chinese	324	8.0	10	10	274	29	....	299	25	11	....	313	....	307
Unknown causes. Others	14	.3	4	....	6	2	1	7	7	3	3	....	7	49
Total	4,044	....	1,359	354	1,727	480	120	2,601	1,443	1,562	568	426	1,461	4,002
Percent to total mortality	....	100.0	33.6	8.7	42.7	11.8	3.0	64.3	35.7	38.6	14.1	10.5	36.1	....
1—Smallpox	22	.5	3	8	10	1	....	13	9	6	9	1	6	36
Measles	7	.2	7	....	....	....	....	3	4	7	....	....	....	60
Scarlatina	255	6.3	160	91	4	....	....	119	136	229	17	....	9	261
Diphtheria	42	1.0	25	16	1	....	....	19	23	38	3	....	1	39
Croup	31	.7	23	8	....	....	....	15	16	29	1	....	1	30
Whooping cough	18	.4	18	....	....	....	....	8	10	17	1	....	....	70
Typhus and typhoid fevers	122	3.2	19	40	55	7	1	72	50	41	25	....	56	98
Diarrhea and dysentery	61	1.5	40	7	10	3	1	31	30	39	6	....	16	55
Cholera infantum	109	2.7	109	....	....	....	....	53	56	105	3	....	1	77
Cholera morbus	11	.3	2	1	4	4	....	5	6	3	....	....	8	7
Pyemia and septicemia	19	.4	....	1	14	3	1	15	4	1	5	1	12	20
Cerebro-spinal meningitis	22	.5	17	3	2	....	....	15	7	18	2	....	2	41
Syphilis	19	.4	2	....	15	2	....	10	9	2	4	4	9	16
Alcoholism	51	1.2	....	1	40	8	2	34	17	2	9	....	36	38
2—Cancer	85	2.1	3	3	46	27	6	47	38	5	25	5	50	66
Phthisis pulmonalis	556	13.7	19	38	430	66	3	400	156	41	112	69	331	543
Hydrocephalus and tubc. men	53	1.2	42	9	1	1	....	28	25	46	3	....	4	52
3—Encephalitis	133	3.3	89	20	17	7	....	81	52	99	11	....	23	142
Apoplexy and paralysis	118	2.9	....	2	56	44	16	84	34	1	28	1	87	67
Convulsions	145	3.6	133	9	3	....	....	83	62	135	7	....	3	121
Other diseases of nervous system	111	2.7	36	12	43	17	3	78	33	44	20	2	45	162
Aneurism	45	1.1	....	....	36	9	....	38	7	....	8	....	36	40
Diseases of the heart	179	4.4	2	15	110	38	14	125	54	13	49	....	115	169
Pneumonia	228	5.6	72	11	92	46	7	154	74	74	43	2	109	226
Bronchitis	48	1.2	22	2	11	10	3	25	23	23	8	....	17	47
Other diseases of respiratory organs	91	2.2	23	3	45	17	3	57	34	26	12	1	51	121
Disease of stomach and bowels	112	2.8	51	6	38	13	4	73	39	53	9	....	49	132
Diseases of the liver	79	2.0	4	2	52	20	1	47	32	7	14	1	56	57
Bright's disease and nephritis	36	.9	2	2	20	10	2	28	8	4	6	....	26	45
4—Puerperal diseases	42	1.0	....	3	39	....	....	....	42	2	9	1	30	51
Atrophy, inanition, old age	347	8.6	265	5	11	21	45	183	164	266	31	4	45	299
5—Suicides	59	1.5	....	....	48	10	1	53	6	....	24	1	33	48
Deaths in institutions	796	19.7	128	38	464	132	34	625	171	141	138	12	499	702
Stillbirths	....	....	....	....	....	....	....	179	108	....	....	....	....	....

NOTE.—In four cases the age was not given, and in twenty-seven the nativity was unknown.

TABLE II.

Mortality by months, with sex, race, nativity, and distribution, for eighteen hundred and seventy-four.

	Total	January	February	March	April	May	June	July	August	September	October	November	December	Total—1873
Total	1,044	392	301	365	301	295	345	355	337	321	379	320	333	4,002
SEX.														
Male	2,601	259	207	243	197	207	231	197	195	213	241	199	212	2,514
Female	1,443	133	94	122	104	88	114	158	142	108	138	121	121	1,488
RACE.														
Caucasian	3,537	343	246	310	265	244	309	314	302	293	332	286	293	3,488
Mongolian	444	40	48	49	35	43	33	35	29	26	42	32	32	451
African	62	9	7	5	1	8	3	6	6	2	5	2	8	62
Indian	1	....	....	1	....	....	....	....	....	....	....	....	....	1
NATIVITY.														
California	1,547	139	104	116	93	100	153	175	134	126	166	134	107	1,650
Other parts of United States	582	64	50	44	43	48	42	49	50	50	50	40	52	606
England	143	15	5	13	15	8	17	3	15	11	13	15	13	132
Ireland	620	60	37	62	54	47	49	49	54	50	48	43	67	539
Scotland	48	7	3	7	4	2	2	5	4	2	4	2	6	37
Germany	222	22	15	20	22	15	20	13	19	22	17	15	22	242
France	83	9	6	7	3	8	6	6	7	5	10	8	8	86
Other European countries	197	21	21	21	17	12	7	11	14	18	18	18	19	136
British American Provinces	58	2	4	7	5	9	4	6	7	2	3	3	6	32
South America	13	1	1	2	1	....	4	....	....	1	1	1	1	13
Mexico	42	6	3	8	4	2	5	1	2	5	1	4	1	29
China	424	40	46	47	35	40	31	32	27	26	41	31	28	423
Other countries	35	1	5	7	4	3	3	2	....	....	4	4	2	41
Unknown	30	5	1	4	1	1	2	3	4	3	3	2	1	36
DISTRIBUTION.														
City wards	3,043	299	223	282	225	218	262	288	250	240	285	236	235	3,146
City and County Hospital	313	23	22	29	27	22	27	21	22	34	22	30	34	258
United States Marine Hospital	29	2	4	4	1	4	....	4	....	2	2	2	4	18
French Hospital	61	6	9	4	1	5	5	4	6	3	8	3	7	51
German Hospital	47	2	5	4	5	6	3	1	5	4	3	4	5	62
Italian Hospital	1	....	1	....	....	....	....	....	....	....	....	....	....	7
St. Luke's Hospital	15	3	1	....	....	1	2	1	3	1	1	2	....	6
St. Mary's Hospital	130	15	9	12	11	9	9	6	15	11	13	10	10	117
Smallpox Hospital	22	8	2	....	2	2	2	....	4	....	1	....	1	34
Almshouse	35	3	4	4	4	1	6	....	4	3	2	1	3	46
Other charities	142	9	12	7	7	13	13	12	12	9	19	18	11	92
Casualties	147	16	8	13	12	10	8	12	12	7	18	13	18	117
Suicides	59	6	1	6	6	4	8	6	4	7	5	1	5	48

REMARKS FOR EIGHTEEN HUNDRED AND SEVENTY-FOUR.

San Francisco has just passed through a year of very general healthfulness. But for the prevalence of scarlatina in epidemic form, which is now rapidly disappearing, the smallness of the mortality must have been remarkable. Notwithstanding a period of unusual prosperity and of undoubted large increase of population, the number of deaths in eighteen hundred and seventy-four was but forty-two more than in eighteen hundred and seventy-three. It is computed by those capable of judging, that at least two thousand houses were built in San Francisco in eighteen hundred and seventy-four. It is probable that the increase in population amounts to at least fifteen thousand. In March, eighteen hundred and seventy-four, careful estimates, based on the lists of names in the City Directory, placed the population at two hundred thousand seven hundred and seventy. If we assume this to be the proper average for the year, we have a death-rate of twenty per thousand; whilst if we exclude the Chinese from our calculations, the mortality rate among our white inhabitants did not exceed, if it reached, nineteen per thousand.

A glance at the report for eighteen hundred and seventy-three, (1) the increase of population being taken into consideration, will show what a very marked improvement has taken place; and yet the observer will be struck with many points of resemblance in the two mortality tables. In the proportion of deaths from the diseases of the great classes, the differences between the two years are extremely small. Thus, in eighteen hundred and seventy-three there were fourteen hundred and forty-one deaths from local diseases, or thirty-six per cent of all the deaths, while in eighteen hundred and seventy-four there were fourteen hundred and thirty-six deaths from these diseases, or 35.5 per cent of the total. The greatest difference between the two years is in the mortality of children under five years of age, and this is in favor of eighteen hundred and seventy-four. In the former year 36.5 per cent of the mortality was of such children, while in the latter, it was but 33.6 per cent, or almost precisely one third of the total. Three per cent of the deaths, in eighteen hundred and seventy-four, were of persons over seventy years of age—a larger rate than prevailed in eighteen hundred and seventy-three. The great disparity in the number of male and female decedents still exists as it existed years ago, but the ratio of males is surely though gradually diminishing. Thus, in eighteen hundred and sixty-one and eighteen hundred and sixty-two, of every hundred deaths, sixty-seven were males; in eighteen hundred and sixty-six, eighteen hundred and sixty-seven, and eighteen hundred and sixty-eight, from sixty-five to sixty-six were males; while in eighteen hundred and seventy-four the males numbered but little over sixty-four in the hundred, which was slightly more than in eighteen hundred and seventy-three. It will be seen, however, that as regards the decedents from zymotic diseases, our table shows an almost equal mortality of the two sexes, while in several instances, as measles, scarlatina, diphtheria, croup, whooping cough, etc., the preponderance is actually in favor of the females. This may be partially explained when it is recollected that the vast majority of deaths from zymotic causes occurs among young children.

(1) The totals for eighteen hundred and seventy-three have been added in the right hand column of both tables.—Sec. State Board of Health.

As regards nativity of decedents, we note that 38.6 per cent were born in California, and that only fourteen per cent, or less than one seventh, had their birth-place in other portions of the United States. On the other hand, about forty-seven per cent, or nearly one half, were foreign born, and of these, over a fifth were Chinese, and about one third Irish.

Turning to individual diseases, we observe that there were twenty-two deaths from smallpox, most of them natives of the United States, and half of them under twenty years of age. This disease has now entirely disappeared from San Francisco, no death having occurred for several months, and the only case for a length of time being one that arrived overland from St. Louis. Scarlatina caused five hundred and sixteen deaths in the two years eighteen hundred and seventy-three and eighteen hundred and seventy-four, during which it proved as severe an epidemic of this disease as ever visited our city. Nearly all the decedents were under ten years of age, and two thirds were under five years of age. As was to be expected, they were, with few exceptions, natives of California. A material decrease in the number of deaths from diphtheria, croup, and whooping-cough occurred in eighteen hundred and seventy-four, but from cholera infantum there were nearly half as many more. Typhoid fever was also more fatal; and precisely one half of the deaths (sixty-one) occurred in four months—August, September, October, and November.

The actual increase in the number of deaths reported from consumption is very small; in fact, but thirteen. It will be seen, however, that the native-born decedents have largely diminished, and the foreign as largely increased. Just four hundred, or nearly three fourths of the deaths, were of foreigners. Precisely the same number were males. From pneumonia there was an average mortality of precisely nineteen per month, two thirds being males and about one half foreign born. If we associate all diseases of the respiratory system under one head, we have a total of nine hundred and twenty-three deaths, or nearly one fourth of the entire number; and of these nearly two thirds were between the ages of twenty and fifty years.

The number of deaths in public and private institutions was large, but when it is remembered that there were treated in them over seven thousand patients in eighteen hundred and seventy-four, and that about seven hundred patients are constantly beneath their roofs, it will not be considered excessive. If we exclude those under five years of age, nearly all of whom were in fact but a few weeks or months old (foundlings), the foreigners comprise over seventy-five per cent of all dying in the hospitals, showing what class patronizes these institutions. Let it be understood, however, that about one third of the deaths occurred in the private hospitals, such as the St. Mary's, the French, and the German, where patients are required to pay for their care, and hence are not charity patients.

During the latter half of eighteen hundred and seventy-four, a record of the nativity of parents of minors was kept. From this it appears that in the seven hundred and sixty-six instances in which the facts were given, only one hundred and twenty-three decedents had native-born parents; five hundred and sixty-seven had foreign-born parents; and in seventy-six cases the parentage was mixed. This is simply another proof of the great preponderance of the foreign element.

The deaths from violence were considerably in excess of the number in eighteen hundred and seventy-three. The number of suicides was greater, and probably San Franciscans have not forgotten the extraordinary number of homicides (twenty-seven), most of which occurred early in the year. These served in the main to make the increase in fatal casualties over eighteen hundred and seventy-three. Finally, a few more stillbirths were reported in eighteen hundred and seventy-four, the males as usual being in excess.

VITAL STATISTICS OF SACRAMENTO.

ESTIMATED POPULATION, 1874.

	Inhabitants.
The City Directory gives the names, over twenty-one years of age, of	7,000
The school census enumerates children under seventeen years of age	5,821
Females over seventeen years of age not enumerated in either directory or school census	5,000
Males between seventeen and twenty-one years of age not enumerated in either directory or school census	1,500
Chinese, Negroes, and Indians, not enumerated in either directory or school census	1,679
Total permanent population of Sacramento	21,000

Months.	Birth-rate.			Death-rate.		
	Males.	Females.	Total.	Males.	Females.	Total.
January	13	12	25	13	9	21
February	12	13	25	21	14	35
March	16	7	23	20	15	35
April	4	10	14	15	9	24
May	10	9	19	13	7	20
June	9	11	20	17	8	25
July	11	11	23	16	8	24
August	14	8	22	18	10	28
September	14	10	24	14	7	21
October	14	19	33	19	7	26
November	18	9	27	17	8	25
December	16	9	25	21	7	28
Totals	151	128	279	204	109	313

The records of all times and places establish, beyond question, that the causes which determine a low death-rate tend likewise to determine a high birth-rate. The exceptions occasionally found to this law owe their existence to the fact that some cause of death is particularly active amongst the unproductive members of the community. As, for example, measles, or any other disease of childhood, may increase the death-rate to a very decidedly larger figure without sensibly affecting the birth-rate. But this is generally a temporary cause, as affecting the death-rate, and does not invalidate the rule, that the birth-rate is in inverse ratio to the death-rate; the lower the latter, the higher the former. As no exception has occurred to interfere with the operation of this law in Sacramento, we conclude that the ordinance requiring returns of births to the Health Board, as shown in the comparatively low birth rate, has, like our State registration laws, been only partially complied with.

ANNUAL TABLE OF THE NECROLOGY OF SACRAMENTO FOR EIGHTEEN HUNDRED AND SEVENTY-FOUR.

CAUSES OF DEATH.	Total	Months.												Sexes.		Ages.										Nativities.		
		January	February	March	April	May	June	July	August	September	October	November	December	Males	Females	Under 1 year	1 and under 5	5 and under 10	10 and under 20	20 and under 30	30 and under 40	40 and under 50	50 and under 60	60 and under 100	Unascertained	Pacific States	Atlantic States	Foreign countries
I.—GENERAL DISEASES.																												
General Diseases, A—																												
Smallpox	1	...	...	...	...	...	...	...	1	...	...	...	...	1	...	...	...	...	...	...	...	1	...	...	...	...	1	...
Scarlet Fever	10	...	2	1	...	...	...	...	3	...	...	2	2	7	3	...	6	3	...	1	...	...	...	...	...	6	3	1
Cerebro-spinal Fever	3	1	...	...	...	...	...	...	1	...	...	...	1	3	...	...	...	...	2	1	...	...	...	...	...	1	1	1
Typho-malarial Fever	15	1	1	1	...	...	1	1	2	1	2	2	3	12	3	...	...	...	2	4	5	4	...	...	...	1	3	11
Pyæmia	3	2	...	...	...	...	1	...	...	...	...	...	...	3	...	...	...	...	...	...	1	1	...	1	...	...	2	1
Fever, Puerperal	1	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	1	...	...	...	...	...	...	...	1
General Diseases, B—																												
Syphilis	1	...	...	...	...	...	1	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	1	...	...	...	...	1
Cancer	6	...	...	1	1	...	1	...	...	2	...	1	...	3	3	...	...	...	...	...	1	...	1	4	...	...	3	3
Consumption	53	4	6	7	5	4	5	3	5	2	4	3	5	36	17	...	...	1	8	18	15	9	2	...	...	7	21	25
Anæmia	2	...	...	...	...	...	1	1	...	...	...	...	...	1	1	...	2	...	...	...	...	...	...	...	...	2	...	...
Dropsy	6	...	...	1	1	1	1	...	...	...	...	2	...	4	2	...	...	...	1	2	1	...	2	...	...	...	3	3
II.—LOCAL DISEASES.																												
Diseases of the Nervous System—																												
Meningitis	20	1	2	1	1	4	4	1	...	2	3	...	1	12	8	5	6	5	...	...	1	2	1	...	...	12	7	1
Apoplexy	6	...	...	2	1	...	2	...	1	...	...	...	...	4	2	...	...	...	...	...	...	2	1	3	...	...	4	2
Paralysis	4	...	...	1	1	1	...	...	1	...	...	...	...	2	2	...	...	...	...	...	...	2	...	2	...	...	1	3
Convulsions	13	3	1	2	...	...	1	1	...	4	1	2	...	8	5	5	7	1	...	...	...	...	...	...	...	13	...	...
Other diseases of this group	4	...	1	1	...	...	...	...	...	...	1	1	...	3	1	...	...	...	...	...	...	...	3	1	...	...	2	2
Diseases of the Circulatory System—																												
Heart, Disease of	13	...	4	1	2	2	...	...	...	1	1	...	1	8	5	...	...	...	1	3	5	2	1	1	...	...	11	2
Cyanosis	2	...	...	...	...	...	...	...	...	1	1	...	...	1	1	2	...	...	...	...	...	...	...	...	...	2	...	...
Aneurism	4	...	1	...	...	...	...	...	2	...	...	...	1	4	...	...	...	...	...	1	1	...	...	1	1	...	...	4
Diseases of the Respiratory Organs—																												
Laryngitis	1	...	...	1	...	...	...	...	...	...	...	...	...	1	...	...	1	...	...	...	...	...	...	...	...	1	...	...
Bronchitis	3	...	...	...	...	...	...	...	1	...	...	...	2	...	3	1	2	...	...	...	...	...	...	...	...	3	...	...

CAUSES OF DEATH.	Total	January	February	March	April	May	June	July	August	September	October	November	December	Males	Females	Under 1 year	1 and under 5	5 and under 10	10 and under 20	20 and under 30	30 and under 40	40 and under 50	50 and under 60	60 and under 100	Unascertained	Pacific States	Atlantic States	Foreign countries
Pneumonia	21	2	3	5	3	1	...	2	1	1	1	2	...	11	10	...	5	2	1	1	2	5	3	2	...	8	6	7
Hæmoptysis	2	...	1	...	...	...	...	...	...	...	...	1	...	2	...	...	1	...	...	...	...	1	...	...	...	1	...	1
Other diseases of this group	10	...	2	2	1	...	...	...	2	...	1	1	1	7	3	3	1	...	1	1	1	...	2	1	...	5	1	4
Diseases of the Digestive System—																												
Gastritis	7	1	2	1	...	...	2	...	1	...	...	...	...	5	2	2	2	1	...	...	1	1	...	...	...	5	...	2
Enteritis	4	...	1	...	...	1	...	...	...	...	2	...	...	2	2	2	1	...	...	...	...	...	...	1	...	3	1	...
Dysentery	4	...	...	...	...	...	...	2	...	1	...	...	1	2	2	1	...	...	...	2	1	...	...	...	...	2	2	...
Diarrhea	3	1	...	...	...	...	...	1	...	...	...	1	...	1	2	3	...	...	...	...	...	...	...	...	...	3	...	...
Cholera Infantum	1	...	...	...	...	...	...	1	...	...	...	...	...	1	...	...	1	...	...	...	...	...	...	...	...	1	...	...
Hernia	2	...	...	...	...	...	...	...	1	1	...	...	...	2	...	...	...	...	...	...	...	...	1	1	...	...	1	1
Other diseases of this group	5	...	...	1	...	...	1	...	...	...	2	1	...	4	1	1	...	...	...	...	1	3	1	...	...	1	1	3
Diseases of the Urinary System and of the Male Organs of Generation—																												
Bright's Disease of the Kidneys	7	...	...	...	...	...	1	2	...	...	2	1	1	5	2	...	...	1	3	1	2	...	...	...	...	1	2	4
Diseases of the Female Organs of Generation—																												
Diseases of the Uterus	1	...	...	...	...	...	...	...	...	...	...	1	...	...	1	...	...	...	...	...	...	1	...	...	...	...	1	...
Metro-peritonitis	3	...	...	...	...	...	...	1	1	...	...	...	...	...	2	...	...	...	...	1	1	...	...	...	...	...	2	...
Affections connected with Pregnancy—																												
Abortion	1	...	...	...	...	...	...	...	...	...	1	...	...	...	1	...	...	...	...	1	...	...	...	...	...	...	...	1
Puerperal Convulsions	2	...	...	...	...	...	...	...	...	2	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...
Diseases of the Organs of Locomotion—																												
Diseases of the Bones	1	...	...	...	...	1	...	...	...	...	...	...	...	1	...	...	...	...	1	...	...	...	...	...	...	...	...	1
Diseases of the Integumentary System—																												
Abscess	1	...	...	1	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	1	...	...	...	...	...	...	1
III.—CONDITIONS NOT NECESSARILY ASSOCIATED WITH GENERAL OR LOCAL DISEASES.																												
Stillborn	24	6	1	1	1	3	1	...	1	2	3	2	3	16	8	24	...	...	...	...	...	...	...	...	...	24	...	...
Old Age	4	...	1	1	1	...	...	...	...	1	...	...	...	2	2	...	...	...	...	...	...	...	...	4	...	...	2	2
Debility	15	1	1	2	2	1	1	2	1	...	1	1	2	10	5	7	3	1	...	...	...	2	1	1	...	11	2	2
Premature Birth	5	...	1	...	1	...	2	1	...	...	...	...	...	4	1	5	...	...	...	...	...	...	...	...	...	5	...	...
IV.—POISONS.																												
Alcohol	4	1	...	...	1	...	...	...	1	...	1	...	...	3	1	...	...	...	...	...	1	1	2	...	...	...	2	2
Poison not specified	2	...	...	...	...	...	...	1	...	1	...	...	...	1	1	...	1	...	...	1	...	...	...	...	...	1	...	1
V.—PARASITES.																												
Worms	1	...	...	...	...	...	1	...	...	...	...	...	...	1	...	...	1	...	...	...	...	...	...	...	...	1	...	...
VI.—MALFORMATIONS.																												
Malformations	1	...	...	...	...	...	...	1	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	1	...	...
VII.—ACCIDENTS AND INJURIES.																												
Drowning	7	1	1	...	...	...	...	2	1	...	1	...	1	7	...	...	...	...	1	2	2	...	2	...	...	1	...	6
Gun-shot Wounds	1	...	...	...	...	...	...	1	...	...	...	...	...	1	...	...	...	...	...	...	...	...	1	...	...	...	...	1
Other Wounds	1	...	1	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	1	...	...	...	...	...	1
Railroad Accidents	2	...	...	...	...	...	...	...	...	1	...	...	1	2	...	...	...	...	...	1	...	...	...	1	...	...	1	1
Other Accidents	3	...	...	...	2	1	...	...	...	...	...	...	...	1	2	...	...	2	...	...	...	1	...	...	...	1	2	...
Suicide	5	...	...	...	1	...	...	...	...	1	1	1	1	4	1	...	...	...	...	...	2	2	...	1	...	...	4	1
Unknown Causes	16	2	3	2	...	2	...	...	2	1	...	2	2	13	3	3	1	...	1	...	2	3	2	2	2	5	...	11
Totals	337	28	36	36	25	23	26	24	29	23	29	27	31	225	112	71	37	16	23	42	53	41	24	27	3	131	92	114

MONTHLY AND ANNUAL MORTALITY OF SACRAMENTO,

From the founding of the city to the present time—a period of twenty-five years.

MONTHS.	1850.	1851.	1852.	1853.	1854.	1855.	1856.	1857.	1858.	1859.	1860.	1861.	1862.	1863.	1864.	1865.	1866.	1867.	1868.	1869.	1870.	1871.	1872.	1873.	1874.
January	....	37	19	44	37	81	27	17	24	27	47	42	34	35	35	30	23	25	34	49	47	28	20	31	22
February	....	36	21	29	16	17	32	11	17	15	32	29	33	25	24	23	20	21	25	38	30	24	26	29	35
March	....	21	23	21	23	19	16	16	25	24	26	21	33	27	29	27	26	28	21	38	26	31	21	30	35
April	10	22	18	28	12	16	30	23	22	18	35	29	24	22	44	22	19	28	22	43	23	24	25	31	24
May	22	13	20	20	16	17	25	29	31	19	37	22	29	26	41	22	29	27	27	41	36	38	26	37	20
June	30	13	29	18	19	20	26	24	27	22	33	20	23	30	38	20	28	24	56	33	36	26	40	33	25
July	31	15	45	15	20	17	28	22	17	32	41	24	36	26	26	33	27	20	58	31	31	28	37	26	24
August	47	15	77	41	20	26	35	34	24	26	22	33	23	30	27	29	19	20	42	35	31	28	19	39	28
September	57	20	185	9	20	22	25	22	24	24	28	26	22	32	56	34	30	24	32	39	29	34	34	24	21
October	325	21	79	37	32	31	45	23	34	31	39	37	34	35	33	53	38	26	35	48	50	32	35	46	26
November	326	28	76	31	27	33	23	42	30	30	45	40	34	45	41	38	28	19	53	57	46	27	28	35	25
December	52	39	43	40	23	26	21	25	27	39	51	37	25	49	32	27	29	25	39	43	33	24	41	32	28
Totals	900	280	635	333	265	324	333	288	302	307	436	361	353	380	426	358	316	287	444	485	418	344	352	403	313

In 1850 and 1852, Asiatic cholera was epidemic. In 1855, of the 81 deaths in January, 65 were caused by the explosion of the steamer Pearl. In 1860, scarlatina and diphtheria prevailed epidemically. In 1864, the explosion of the Washoe swelled the mortality. In 1868-9, smallpox was epidemic.
Population, 21,000. Ratio of deaths per 1,000 of the population, or death-rate, 14.9, in 1874. Stillborn not included.

HOSPITALS, ASYLUMS, PUBLIC INSTITUTIONS, ETC.

Among other requirements of the organic law, it is directed that "the State Board of Health shall place themselves in communication with the Local Boards of Health, the hospitals, asylums, and public institutions throughout the State, and shall take cognizance of the interests of health and life among the citizens generally. They shall make sanitary investigations and inquiries respecting the causes of disease, especially of epidemics, the sources of mortality, and the effects of localities, employments, conditions, and circumstances on the public health; and they shall gather such information in respect to these matters as they may deem proper for diffusion among the people."

In the discharge of the different duties here set forth, which naturally interlock with each other, and refer to subjects of which a competent knowledge is necessary in order to advisement as to the state of the population in health and disease, and as to unwholesome conditions and their abatement, I would here refer to the action which has been taken with regard to our County Hospitals, and which will be best explained by the following circular:

OFFICE STATE BOARD OF HEALTH,
SACRAMENTO, August 15th, 1874.

To the Supervisors and Hospital Physicians of the various counties in the State:

Complaints having reached this office of the generally faulty condition and mismanagement of our County Hospitals, I have been instructed, by a resolution of the Board I represent, to inquire into the matter, and to adopt such measures as the circumstances of the case may, in my judgment, seem to require. Acting upon this authority I have deemed it proper to submit this circular to the consideration of Supervisors, Physicians, and all others interested.

From the inquiries instituted it appears that the causes of complaint are found, not only in the structural and dietetic provisions of these hospitals, but also in their medical administration. In several instances the indigent sick are let out, *per capita*, to the lowest bidder, to provide hospital accommodations, nursing, diet, medical attendance, and medicines. That such a system of economical provision for the sick must necessarily lead to great abuses, and defeat the beneficent object for which these hospitals are designed, the facts of the case, as far as I have been able to ascertain, clearly establish. In one instance, to which my personal attention was recently called, the rented house, used as a County Hospital, was found to be old, dilapidated, and without ventila-

tion, save nine little windows, in all, distributed in the six small rooms, into which the building was divided up, and which did not afford one fourth of the *absolutely* requisite surface-area for the twenty-six patients crowded therein. The feeding, nursing, medical attendance, and medicines were also furnished by the contract system. On remonstrating with the Supervisors, who gave me a hearing at a subsequent visit, in compliance with the request of the County Physician—these officials, I am now happy to say, soon became convinced of the impropriety of the system that had been pursued. Besides promising reform in the general administration of hospital matters, they fully authorized me to have such building plans and instructions prepared, as I might deem necessary for the proper care of the indigent sick, at the expense of the county. Believing that the case cited is one among many, in which the same grievances obtain, and which a little exertion on the part of the physicians and all others interested, is calculated to redress, I have thought it expedient to present briefly the arguments then adduced, in connection with other matters, which the object of this circular suggests.

It is taken for granted that the reason for the establishment of County Hospitals is that, by aggregation, the sick may be restored to health at a minimum cost, because of the relatively small number of nurses, physicians, and other attendants that suffice for their care and treatment. Now the principles which underlie this proposition, both from an economic and humane point of view, and to the enforcement of which all other considerations should be subservient, exact, that the sick shall be, by this means, restored to health as speedily as possible, and, above all, that the hospital shall do the sick no harm. This latter condition, which was first enunciated by Florence Nightingale, several years ago, is predicated upon the fact, that it not unfrequently occurs that patients enter hospitals with simple diseases, or trivial injuries, and contract therein other, and more lingering maladies, of which they often die. Thus the efficiency of a hospital is found, not in the large proportion of sick restored to health, but in the average time that has been required for this object. A hospital which restored all its sick to health after an average of three months' treatment, cannot be considered so well adapted to its purpose as a hospital which discharged all its sick recovered in as many weeks. Besides this test, sanitarians and others who have devoted their attention to hospital reform, maintain that the origin and spread of diseases in a hospital, such as typhoid fever, erysipelas, hospital gangrene, and pyæmia generally, are much better proofs of the defective qualities of a hospital proper, than its statistics. The defects, to which such accidental diseases are attributable, are found to consist in unfavorable sites, improper plans, bad sewerage, want of ventilation, and overcrowding; and it is to these important points, on which the efficiency of all hospital treatment depends, that I wish to call special attention. The wards of a hospital are unlike every portion of an ordinary dwelling, occupied day and night, inasmuch as the usual excretions, which are constantly escaping from the system through the lungs and skin, and which even in health are deleterious elements, become in disease more actively and even specifically poisonous. Suppurating surfaces throw into the air pus-cells in a state of decay—special diseases give out their special poisons, while the fæcal and urinary discharges, from so large a proportion of persons, add their foul influence to the decomposing organic matters, and make them still more dangerous.

The result of all this is that a pernicious atmosphere accumulates, which, if not continuously and rapidly removed by adequate ventilation,

sewerage, and cleansing, soon pervades every part of the building, and after a longer or shorter period—depending upon the amount of air-space to each patient, and the ventilation and cleanliness observed—the floor, walls, furniture, and bedding become saturated with a miasm, which is capable of poisoning a large percentage of the inmates, and which, if it does not inflict other diseases than the one for which they were admitted, at all events lowers the vital force and prolongs the original malady.

Now we have reason to apprehend that most of our County Hospitals, which have been constructed without a thought as to site, drainage, ventilation, or the prerequisite cubic space of air to each patient, are precisely in a condition presenting all the dangerous qualities just alluded to. From such considerations, and in accordance with the advanced views of those who have studied the subject of hospitalism, it becomes imperiously necessary to provide a radical remedy—and that remedy consists in the abandonment of all contaminated hospitals—in fact, of all hospitals which have been in service more than ten years, and the construction of entirely new buildings, with all the essential requirements. Fortunately, it so happens, as an additional incentive to the accomplishment of this end, that the most economical mode of hospital construction has proved to be the safest for the sick. What is now the so-called pavilion hospital, built entirely of wood, and calculated for only ten or fifteen years use, is everywhere superseding the substantial and costly hospitals which were wont to be built as "monuments for all time" of a charitable community.

Without extending these remarks to an inappropriate length at this time, and inasmuch as it is proposed to publish in the next biennial report of this Board full instructions, illustrated by plans, for the construction and arrangement of the kind of hospital here advocated, I will simply refer to the recently erected City and County Hospital of San Francisco, as an example. A plan, conforming in all essential particulars to this pavilion hospital, which is built of redwood, has been adopted by the Supervisors of Solano County, consisting of two detached wards of one story in height, capable of accommodating twenty-six patients, and connected by an open piazza with the appropriate offices and other rooms, which, when constructed, will not cost over eight thousand dollars. The architect, Mr. A. A. Cook, of Sacramento, who has prepared this plan under my immediate supervision, will modify it to accommodate any number of patients, be it more or less, if called upon to do so, at a very moderate charge. I respectfully urge this method upon the attention, especially of all our county physicians, as one dictated by every humane consideration, and calculated to do justice as well to the sick and suffering as to their medical treatment. To facilitate the procurement of statistics, on which to predicate an opinion as to the sanitary conditions and remedial results of each hospital, suitable blank forms have been prepared, which it is requested will be returned, properly filled out, quarterly, to this office.

THOS. M. LOGAN, M. D.,
Permanent Secretary State Board of Health.

In accordance with the views above expressed, a few only of the counties have adopted the plans suggested. In order to expedite the action of others, I have caused the accompanying plans and instructions to be prepared by a competent architect (Mr. A. A. Cook), which, it is hoped, will accomplish all the objects for which they were designed.

CONSTRUCTION OF HOSPITALS, ILLUSTRATED WITH PLANS.

The causes which render a badly constructed hospital unhealthy, are due to those natural influences which are continually at work in the body, suffering from disease, to restore it to the normal condition of health. The lungs and skin are two great channels through which constantly escape from the system, even in health, the most deleterious or poisonous elements. In disease these emanations become more actively, and even specifically poisonous; hence a number of patients congregated in a common ward generate a miasm which accumulates, if not rapidly removed by adequate ventilation, until every part of the room is pervaded, and after a longer or shorter period, depending upon the persistency and degree of cumulation, the floor, walls, furniture, and bedding of the ward become saturated with a miasm which is capable of poisoning a large percentage of those who are exposed to its influence.

It is believed that the evils above mentioned may be avoided by conforming to the following general system of construction and disposition of hospitals on the pavilion plan and heated-shaft system of ventilation. Two designs (Plates I to IV) are here presented for two small frame hospitals, on the pavilion plan, which were expressly prepared for this report, and will serve as an illustration in the following discussion of hospital construction.

The site should be free from nuisances of every kind, abundantly supplied with pure fresh water, sufficiently elevated to insure good surface and subsoil drainage, and isolated to an extent sufficient to give the necessary exposure to currents of air. The hospital proper should consist of pavilions or separate detached buildings (Plates I and II), one story in height preferable, and of simple architectural design, constructed with the view of destroying them, so soon as the peculiar hospital diseases, erysipelas, pyæmia, gangrene, etc., are engendered by the cumulated miasm of the patients: a condition which usually obtains after the continued use of a ward for ten or fifteen years—the time depending mainly upon the amount of air-space to each patient and the character of the ventilation. A pavilion hospital with two floors (Plates III and IV) is not seriously objectionable, provided the system of ventilation is distinct for each floor.

There should be but one ward to a floor; cross-walls or partitions obstruct the ventilation, and the only plan in which two wards on one floor are admissible, is where the administrative offices and stairways to the upper wards are in the center of the building, with access to the wards right and left (Plate III).

Wood is preferable in the construction, framed in balloon style, covered outside with rustic, and well painted, and have shingled roofs; the floors should be at least six feet above the ground, made of hard close-grained wood, such as cherry, ash, or Mendocino pine, laid with lead paint in the joints, and the top surface should have one or two coats of oil and wax to prevent the floors from absorbing moisture. The interior walls and ceilings may be plastered and left in the sand finish, painted and varnished, or lined with building paper over the framework, and have one or two coats of varnish; the latter is only about half the expense of plastering, and answers every purpose. White hard finish

in plastering never should be used in hospital construction. The inside wood work of a ward should be very plain, so as to be easily cleaned, and should always be varnished.

The executive building should be centrally located, so as to admit of easy and rapid communication with the other buildings, and contain the surgeon's office, reception room, operating room, and private ward, etc. The second or third story can be used for sleeping apartments for the stewards, apothecary, matron, etc.

The kitchen building should be separated from the executive and ward buildings with an open piazza or well-ventilated corridor. The basement of this building can be used for the laundry, mending and ironing rooms, etc., and should have a well-constructed shaft or chimney erected in the center of the building, and all the smoke and waste heat should be conveyed into this shaft for ventilation of the entire buildings.

The ward buildings should be arranged on parallel or radiating lines running north and south, thereby securing the morning and evening sun to the patients. Plate I and II is arranged to either face the north or south, and Plate III and IV is arranged to face either the east or west; and either design will secure the morning and evening sun to the patients. Small wards are necessary in connection with a hospital, for the purpose of isolating certain patients; but such wards should be independent of the large ones, if possible. The windows of a ward should be opposite to each other, and the top sashes should be hung on weights, and have closely fitted frames covered with fine wire netting, to be used for Summer ventilation, when desired. It is better to keep the windows closed when the mode of ventilation herein described is properly constructed.

The principal nurses' rooms should be placed near the entrance of the ward, and provided with a window which commands a view of its entire length. The linen closets should be near and accessible to the nurses' room.

The bath room should be separated from the ward by a well-ventilated passage, and supplied with bath-tub for hot and cold water, sitz and steam bath, and porcelain wash-basins.

It is desirable to have a room connected with each ward, where the patients, who are able to leave their beds, can sit during the day to read and smoke.

The water-closets should be separated from the passage to the ward by a door fitted to swing both ways, which should always remain closed when not in use. The basins should be well supplied with water, and have strong traps, and the seats should be arranged with close-fitting covers.

The sink for ward slops, etc., should be in the same department with the water-closets. In order to insure the most perfect ventilation possible, there should be a chimney or exhaust shaft erected (*a*. Plate I and III), of sufficient capacity to remove all the foul air from the various rooms in the building, and inside of this shaft there should be a sheet iron pipe, to extend the entire length, and the smoke and waste heat from the kitchen, laundry, etc., should be conveyed into this pipe, which will raise the temperature of air in the shaft, and make it pass off very rapidly. There should be air-tight horizontal tubes (*bb*. Plate I and III) laid from the ventilating flue of this shaft to each ward or room to be ventilated, terminating in openings (*cc*. Plate I and III) through the floor or baseboards. In addition to this exhaust shaft or chimney, there

should be open fireplaces or grates provided in the executive building, and open grates, or flues for heaters, provided at each end of the wards, with openings at the bottom of the room, near the floor.

The hospital should be warmed by passing an abundance of pure fresh air through a hot air furnace or over coils of steam pipes placed in the basement, having tubes or ducts terminating with registers in the floor, at the furthest point possible from the foul-air openings.

For Winter ventilation, the fresh air should be moderately warmed before being admitted into the wards; and in Summer, the fresh air should be cooled, by either placing ice or buckets of fresh water in the tubes or ducts, thereby producing abundance of evaporation, cooling the air, and supplying the proper degree of watery vapor.

This method of natural-forced ventilation is extremely simple, when properly understood, and fully meets the requirements demanded, without producing any unpleasant draughts; and the extra cost of the shaft, tubes, etc., is but a few dollars more at most, than if there was no ventilation provided.

The drainage should be underground, and all inlets to the sewers should be properly trapped, and no drain should pass under the buildings. Care should be taken that no fresh air flue should open near the sewers.

The following is an explanation of the plans here presented, reference to the figures on each plan being the same, which could be either enlarged or reduced in size to suit the requirements demanded for such a building, simply giving a general idea of a pavilion hospital:

EXECUTIVE BUILDING.

No. 1 is the reception room; 2, office, and each is 12x15 feet; 3, operating room and laboratory; 4, private ward, and each is 12x14 feet; this story is 12 feet high; 11, hall, with stairs leading to the basement and second stories, where the general stores, water-closet, and dead-room are in the former, and sleeping rooms, closets, etc., are in the latter.

REAR BUILDING.

No. 5 is the general dining room, 15x22 feet; 6, kitchen, 14x22 feet; 7, kitchen stores, 5x9 feet; 8, dish pantry, 5x9 feet; the laundry, ironing, and mending rooms may be arranged in the basement story of this building; 9, platform, with steps on each side of the kitchen; 10, open piazza, 12 feet wide, and extending to all of the buildings, with steps, etc., on each side of the executive building.

WARD BUILDINGS.

No. 11 is the passageways, 6x15 feet; 12, nurses' rooms, 11x15 feet; 13, linen closets, 6x9 feet; 14, bath rooms, 8x9 feet; 15, ward rooms, 25x50 feet, and 16 feet high; 16, smoking and reading room, 10x17 feet; 17, ward water-closets, 8x10 feet.

As with a similar table, published in the last report of this Board, the accompanying table compares most favorably in its results with the showing of the best ordered hospitals in the world. Taken in connection with the fact of their crowded condition, and short allowance of cubic space for air to each patient, and necessarily defective ventilation, especially in the instances of the Lunatic Asylum, the hospital wards of the San Francisco Almshouse, and of the State Prison, and most of the County Hospitals and jails, these results afford the most unequivocal evidence of the benefits that have accrued from their skillful medical administration.

It may here, with some reason, be asked, if these facts be so, why is it that so much space has been given in this report to the construction and hygiene of hospitals?

Now, it must be remembered that the hospitals, prisons, etc., mentioned in these statistics, have been constructed of recent date, and, although defective in most hygienic respects, still have not yet become so permeated with organic impurities emanating from the bodies of the sick, as to render them comparable in percentage of mortality to other hospitals; but this state of things may not continue much longer. The safety of patients requires freshly built wards, for it is now beginning to be recognized that hospitals should be destroyed and renewed every ten years.

It seems probable that the chances of recovery from fever or from the results of a surgical operation are, on the whole, greater in a squalid home in any large city, even, than in the largest and best appointed hospital in London or Paris—so dangerous is the concentration of many sick to each individual patient. An influence capable of causing disease, emanating from one or from a few individuals, is usually so dissolved and diluted as to be harmless. From a large ward, however, exhalations perceptible to the smell are generated, which saturate the very walls, and poison successive series of inmates. That noble and learned physician, Sir James Y. Simpson, who first proved the virtue of anæsthetics, by inhaling chloroform himself, among his other priceless benefactions to humanity, taught the true doctrine of hospitalism. By the answers to an extended series of circular letters of inquiry, he established the fact that out of two thousand and eighty-nine cases of amputations performed in great hospitals in cities, eight hundred and fifty-five died, while in country practice, out of two thousand and ninety-eight similar operations, only two hundred and twenty-six died. Hence, the number that die after amputations in hospital practice, when compared with rural practice, is nearly four times greater. In the study of hospital hygiene, during the last few years, the fact has been disclosed again and again that the great hospital is as liable to destroy life as to save it. This fact led Florence Nightingale to enunciate as the very first requirement in a hospital, "that it should do the sick no harm."

These remarks respecting the detrimental influences of the agglomeration of a large number under one roof, without adequate ventilation, apply with equal force to our jails, prisons, factories, and machine shops, etc. To show how, in one instance among the many that may be adduced, disease is contracted from long confinement in ill ventilated chambers, I will here cite the results of an effort that has recently been made by Dr. A. L. Leach, of Philadelphia, to procure and ascertain, by means of the vital statistics of the most important prisons in the

United States, the percentage of deaths occurring in these institutions from phthisis. Owing chiefly to the imperfect manner in which the records have been kept, especially in the Southern States, but partial success has been attained—only sufficient to construct the following:

TABLE

Showing the total number of deaths in prisons (those from accident included), the whole number from phthisis, and the percentage. Under the head of phthisis, are included those dying from scrofula.

Prisons.	Period of years	Total number of deaths	Phthisis	Per cent
Moyamensing Prison	32	282	177	62.76
Maryland Penitentiary	20	187	72	38.50
Vermont Penitentiary	2	6	5	83.33
Sing Sing Prison	20	339	113	33.33
Kentucky Penitentiary	12	116	37	31.89
Connecticut Prison	30	177	107	60.45
New Jersey Prison	10	79	60	75.94
Auburn Prison	51	575	231	40.17
Clinton Prison	1	6	2	33.33
Eastern Penitentiary, Pennsylvania	6	51	30	58.82
Totals	184	1,818	834	45.87
California State Prison	5	53	19	35.85

It would, doubtless, add to the value of these statistics to pursue these investigations further—into machine shops, factories, asylums, almshouses, and other charities—and show the influence of close confinement there met with in the development of phthisis; but we think the fact is sufficiently established that all conditions of life, in which confinement occur, have this influence. Accepting the modern doctrine taught by Virchow, that most diseases have a local origin, the facts already collected possess a language that is mute, but eloquent, and should touch the hearts of the humane. "To-day," in the forcible words of the writer first referred to, "consumption pursues its onward march, numbering its victims by thousands and tens of thousands, and we stand appalled. The brilliant eye and hectic flush of phthisis greet us upon every hand in those hurrying from our factories, our machine shops, sewing rooms, countinghouses, and every station of life, and they should cause us to be busy with attempts at the reformation of so much misery and suffering. In every community societies are formed for the 'prevention of cruelty to animals;' but a society is yet to be formed for the noblest of works—the prevention of cruelty to human beings. All over this broad land—in our prisons, in our factories, our schoolhouses, our workshops, etc.—a cry goes up from human misery pleading for more breathing room, more active enforcement of hygienic laws. Men, convicted it may be of some petty crime, are sentenced by our Courts to a few months imprisonment, but virtually are *sentenced to*

death. They are incarcerated in cells originally intended for one convict, but now crowded with others. A few months suffice, and the convict perishes, or leaves with the germs of phthisis sown, that in future years end his existence. And yet the evil does not end. These convicts may become the parents of offspring, who may reach years of maturity, and while in its full glory are stricken down with phthisis, and thus the sources of so much human misery and woe may continue. We want in this country more prison room, houses of correction for the class of our criminals convicted of minor offenses, and the strict observance of the laws of hygiene. Human beings are packed and crowded together in the public institutions of our cities, in the hovels of the poor, and even among our better classes; shut up through the day, emerging to spend their nights in dissipation, and are yearly dying by thousands, swelling the mortality of consumption. These deaths plead in trumpet tongues, and ask us to be busy with the problem 'How is the evil to be remedied?'"

The Executive Committee of the Prison Association of New York, in their annual report for eighteen hundred and sixty-nine, introduce the subject of the county jails of that State in the following language: "A popular preacher in Brooklyn said recently in a sermon: 'Look at our jails! They are a disgrace to civilization. Some are fit to put wild beasts in, but most of them are not.' The rhetoric is strong here, but there is a terrible basis of truth underlying it. There may be half a dozen jails in the State properly constructed to meet the exigencies of the existing system, but in general they are as faulty in construction and arrangement as they well can be—dark, damp, cramped, ill ventilated, and gloomy in the extreme." This description might also have been written for the jails in California. We have reason to hope, however, that the advancing civilization of the age, and the knowledge to be derived from the attraction of public attention at this time to the general subject of prison management, will not permit this condition to be permanent. Mistaken and ill-judged economy no doubt contributes largely to produce the miserable state of so many of our prisons and jails, and the question of cost will be one of the obstacles to reform. Assuming, however, that public sentiment, once awakened, will insist upon improvement, the necessity for rebuilding or remodeling a great majority of the county jails becomes at once apparent.

The authorities in our metropolis have taken a step in the right direction by the passage of an ordinance punishing every person who does not allot to himself or herself five hundred cubic feet of air in the sleeping apartment. Up to this time, however, all prosecutions for the violation of this law seems to have been directed exclusively to the Chinese. The original intention of awarding five hundred cubic feet of air to each individual in a sleeping apartment was to fix a standard for the construction of hospitals, and the size of the building and its apartments were made to correspond in that proportion to the number of patients admitted. No one ever dreamed that it should be applied as a hygienic rule for every-day life, or adopted as a guide for legislative action. A room ten feet high and seven feet square will give four hundred and ninety cubic feet of air, and is sufficient, under ordinary circumstances, for one person; but if that room be void of ventilation, the atmosphere will become so vitiated in the course of twenty-four hours as to be absolutely poisonous. It is not so much a question of cubic

feet, but one of ventilation, which is really at issue, and it would seem from present appearances as if it were intended that the cubic feet principle was to be applied solely to the Chinese portion of our population. As, however, our city authorities have taken the initiative, it is respectfully suggested that our Legislature would enact a State law requiring, at least, all the State institutions to be regulated by a similar five hundred cubic feet of air statute. That such a law is imperiously required, we will point, as an example, to our State Prison.

While we take pleasure in stating, that under the unremitting and scrupulous attention and energy exercised by Governor Pacheco and the resident surgeon, Dr. Randle, the sanitary condition of the prison has been greatly improved, still there remains an urgent necessity for more breathing room, which can only be attained by pushing forward with alacrity the branch prison now in course of construction at Folsom. As shown by the statistics, furnished by the surgeon to date, the average number of prisoners has increased, since the last biennial report, from nine hundred and twenty to one thousand and fifty, and there is a strong probability of a still further increase, judging from the general character of the immigrants now daily arriving.

It is true, notwithstanding this increase, that the average cubic space to each prisoner has been enlarged by the recent improvements, from one hundred and seventy-seven to one hundred and eighty-four feet; but if this, even now, does not come up to the requisite standard, what may we expect the proportion will be before another year rolls by?

Apart from hygienic considerations, there is a necessity for classifying and grading the prisoners, that those susceptible of moral improvement might be exempted from the contaminating influences of the incorrigibly vicious. This demand can never be met, so long as sixty are allowed to sleep in one room. Some of these may be wholly innocent, others guilty of some slight misdemeanor, and others still, utterly blasted and gangrened by a long course of crime. Is it not supreme injustice to compel a contact of the former with the latter; and is not a State that incarcerates one of her citizens for any cause, bound by every principle of rectitude to use all possible precautions against his being restored to society a worse man than when he was arrested?

Researches into criminal statistics reveal the fact that in the State Prisons of the United States the proportion of minors incarcerated, taking the average in them all, is over twenty per cent; that in one it rises to nearly fifty per cent; and that in several others it exceeds one fourth of the whole number; that the tendency in every department of vice and crime seems to be of late years *youthward;* that thieves, pickpockets, burglars, and indeed every class of criminals average many years younger now than they did a quarter of a century ago, and that the same is true of drunkards. Such being the testimony of the Executive Committee of the Prison Association of New York, an organized and well devised attempt at reformatory discipline, such as our present system does not afford, cannot be begun too soon.

The best example of a reformatory or intermediate prison, is that of the Detroit House of Correction. Its Superintendent, in an able paper, says:

"The design of those institutions is twofold, viz: preventive and reformatory—to restrain and prevent the manifestation of the vicious inclinations of the class described, and to improve the character of the individuals who commit offenses and are imprisoned therefor. The true

interests of society are best promoted by those measures that prevent the perpetration of offenses and the growth of bad character in its members; for every infraction of law not only mars the character of the offender and brings into activity a bad element, but is a shock to the fabric of society, weakening the whole structure in proportion to the trivial or heinous character of the offense. The Christian institutions, benevolent and charitable societies, and educational establishments, are all, in the nature of their organization, admirably adapted to this work; but as their influence does not perfectly accomplish this end, some other provision is necessary for the treatment of those who break through these restraints, and actually enter upon a vicious course, leading, as vicious practices always do, towards the commission of the higher crimes. * * * * The reformatory designs of these establishments must not and need not be lost sight of in our zeal for their preventive influence, for the highest welfare of the inmates is perfectly consonant with the best welfare of society at large. I do not hesitate to say, that in the reformation of prisoners, and in wise efforts to that end, will be found a key to the true prison system, and the soundest criminal code. * * * * * *

"The design of these municipal or intermediate establishments, then, may be stated to be the treatment of persons who commit offenses against society, known as misdemeanors, with the view to exert a preventive and reformatory power—the preventive force being most surely had, and in largest measure, by locating, constructing, organizing, and administering them for the main purpose of reformation. * * * *

"They must be legislated into existence as a part of society, in harmony with every means she adopts for her preservation and the highest development and welfare of her members. Just as hospitals and asylums are instituted to heal physical and mental diseases, so these prisons should be established to cure moral deformity. They are needed as adjuncts to the various refining and purifying agencies, to make further effort in the same direction for those, who are not held by them, to symmetrical, moral development, and who become an offense to society in spite of them."

TABLE

Exhibiting the number of indigent sick, with the results, in charitable institutions, and the percentage of deaths to the cases, during the year eighteen hundred and seventy-four.

NAME AND LOCATION OF EACH HOSPITAL.	No. of months reported	Total admitted.	Discharged cured	Discharged	Died	Percentage of deaths	Remaining under treatment.	Physicians.
Sacramento County Hospital, Sacramento	12	682	515	....	55	8.0	112	G. A. White, M. D.
Central Pacific Railroad Hospital, Sacramento	12	1,055	995	20	11	1.0	29	A. B. Nixon, M. D.
Colusa County Hospital, Colusa	12	93	64	10	5	5.3	15	J. M. Banks, M. D.
San Bernardino County Hospital, San Bernardino	12	26	10	....	7	27.0	9	J. C. Peacock, M. D.
Fresno County Hospital, Millerton	12	35	19	4	3	8.5	9	Lewis Leach, M. D.
Los Angeles County Hospital, Los Angeles	3	85	32	5	10	11.7	38	H. S. Orme, M. D.
Sierra County Hospital, Downieville	12	37	16	6	8	21.6	7	Alemby Jump, M. D.
Napa County Hospital, Napa City	12	83	59	4	5	6.0	15	M. B. Pond, M. D.
Solano County Hospital, Suisun	12	90	56	7	7	7.7	20	Jas. F. Pressley, M. D.
State Prison Hospital, San Quentin	12	91	64	....	7	7.7	20	T. W. Randle, M. D.
Shasta County Hospital, Shasta	9	38	19	....	5	13.1	14	J. E. Pelham, M. D.
San Francisco City and County Hospital	12	3,547	1,968	967	275	7.7	337	W. M. Lawlor, M. D.
Calaveras County Hospital, San Andreas	12	75	19	24	8	10.6	24	E. B. Robertson, M. D.
San Mateo County Hospital, Redwood City (1874–5)	12	55	39	10	2	3.6	4	C. A. Kirkpatrick, M. D.
Mariposa County Hospital, Mariposa	12	29	9	7	5	17.2	8	O. F. Shaw, M. D.
San Diego County Hospital, San Diego	12	73	36	14	15	20.5	8	C. M. Fenn, M. D.
State Insane Asylum, Stockton	12	1,733	238	74	179	10.3	1,242	G. A. Shurtleff, M. D.
Sacramento County Dispensary, Sacramento	12	1,080	990	27	10	0.9	53	C. H. Fisher, M. D.
State Woman's Hospital, San Francisco	24	352	113	219	4	1.1	16	John Scott, M. D.
Alameda County Infirmary, Alameda	12	191	97	....	22	11.5	72	C. S. Coleman, M. D.

NAME AND LOCATION OF EACH HOSPITAL.	No. of months reported	Total admitted.	Discharged cured	Discharged	Died	Percentage of deaths	Remaining under treatment.	Physicians.
*Almshouse, San Francisco, (1874–5)	12	314	....	19	47	14.9	248	S. R. Gerry, M. D.
Santa Cruz County Hospital, Santa Cruz	6	41	25	2	1	2.4	13	C. H. Anderson, M. D.
Del Norte County Hospital, Crescent City	12	4	1	1	1	25.0	1	O. B. Adams, M. D.
Modoc County Hospital, Adin	5	2	1	....	....	0.0	1	H. F. Hall, M. D.
Kern County Hospital, Bakersfield	12	20	6	9	1	5.0	4	H. S. Backman, M. D.
Siskiyou County Hospital, Yreka	12	27	19	4	1	3.7	3	D. Ream, M. D.
Sonoma County Hospital, Santa Rosa	12	149	96	21	12	8.0	20	J. B. Gordon, M. D.
Tulare County Hospital, Visalia	6	74	51	6	12	16.2	5	M. Baker, M. D.
Santa Clara County Hospital, San José	12	332	225	....	35	10.5	52	A. J. Cory, M. D.
Home for Inebriates, San Francisco	24	815	780	14	13	1.6	8	A. P. Hayne, M. D.
†St. Mary's Hospital, San Francisco (1874–5)	12	979	498	312	83	8.4	86	C. G. Kenyon, M. D.
‡City Prison, San Francisco (1874–5)	12	625	....	....	14	2.2	....	Chas. Black, M. D.
County Jail, San Francisco (1874–5)	12	971	....	....	1	....	....	Chas. Black, M. D.

* In former reports, the statistics of only those under treatment in the hospital, were given, consequently the percentage of deaths was much greater. A large proportion of the inmates are either hopelessly or partially invalided; and instead of the institution being an almshouse, it might with more propriety be styled an Hospital of Incurables.

† This is a Catholic institution under the charge of the "Sisters;" and the report is made up of the cases occurring in the charge of the visiting physicians, Drs. James Murphy, James P. Whitney, and Geo. H. Powers.

‡ The City Prison Hospital is used as a receiving hospital for all cases of accident occurring in the City of San Francisco. It consists of two suitable rooms, in the basement of the City Hall, containing four beds. Patients are admitted, dressed, and prescribed for, and next day, if necessary, transferred to the City and County Hospital, or sent to their respective places of residence.

In the San Francisco County Jail but one death occurred during the twelve months, as shown in the table, and that was in consequence of congestive chill.

SAN FRANCISCO LYING-IN AND FOUNDLING HOSPITAL.

THOMAS M. LOGAN, M. D.,
Secretary State Board of Health:

DEAR SIR: I am preparing the manuscript for a printed report embracing the period you ask for, and had expected to send you long ere this a copy of it, but one cause of delay after another has prevented its completion; therefore, I send you an abstract from it now.

There have been delivered in the hospital eighty-two patients, of eighty-two children—forty-three males and thirty-nine females; the mothers ranging in age from fourteen years old and upwards. Nearly all were primiparas; their average stay in the hospital not less than heretofore—about four months. In religion, two were Hebrews; thirty-eight Protestants, and forty-two Roman Catholics. Their nativities are: Californians, twenty-one; from other States and Territories, thirty; from foreign countries, thirty-one. The Californians were: from San Francisco, six; Sacramento, two; Yuba County, two; Santa Clara County, two; San Joaquin County, two; Nevada County, one; Solano County, one; Alameda County, one; El Dorado County, one; Contra Costa County, one; Santa Cruz County, one; Monterey County, one—total, twenty-one. Those from foreign countries are: Ireland, eleven; Canada, four; Nova Scotia, two; France, two; Italy, two; Switzerland, one; Africa (born of white parents), one; Mexico, one—total, thirty-one. Not a death occurred among this whole number.

I wish we could say the same of the foundlings, numbering one hundred and eighty-seven, which we have had to provide for. Eighty-two of them were born in the hospital, and one hundred and five were left at the door of the asylum, by parties unknown; making one hundred and eighty-seven. Of these, I have procured the adoption of seventy-four; nineteen were taken by mothers or their friends, and five remain on hand; making ninety-eight saved; leaving eighty-nine to be accounted for. Of these, one was left a corpse in the receptacle at the door of the asylum, with this memorandum: "Please bury my child, for I am too poor to do so." Of five prematures, three were stillborn; one weighed one pound, and died in one hour; and one in four hours; eight died under three days old; the remainder (seventy-five) died from a week upwards; making a larger per cent saved than at any previous report.

Since the former report we have rented the premises then alluded to, and now have two frontages, of thirty feet each, viz: at 762 Mission street and 269 Jessie street, by a depth of one hundred and sixty feet, opened up into one lot, affording a sheltered spot in the open air for the hospital patients and the children of the asylum. The whole is thoroughly drained, by sewers emptying into the Mission street sewer. The premises 269 Jessie street are now wholly occupied for the Lying-in Hospital, affording additional rooms for patients, but we have not had the means to furnish all of them. The rooms, numbering twenty, contain, in the aggregate, upwards of thirty thousand cubic feet of air, and are thoroughly ventilated. The Mission street building, containing eleven rooms, is occupied for the Foundling Asylum, and contains, in

the aggregate, about the same number of cubic feet as the hospital, and is as well ventilated. This building rests upon a lot from which a sand-hill was removed. The front rooms have a southern exposure; consequently our infants occupy sunny rooms throughout the day, obviating the charge made against the rooms they occupied in the Jessie street premises. I can now confidently assert, that so far as sunny and well ventilated rooms are considered in connection with the health of the children, that they are all that can be desired for the largest number hitherto occupying them. These numbers have varied weekly, ranging from five to twenty on hand at a time.

As our institution is so peculiar in its organization, differing from all other special or general hospitals in the State, I have been unable to adapt it to the printed formula you sent me. I therefore hope that the foregoing abstracts will give you the desired information.

Yours, most respectfully,

BENJAMIN F. HARDY, M. D.,

Attending Physician and Surgeon of the San Francisco Lying-in Hospital and Foundling Asylum.

[Office, 762, residence, 824 Mission street, San Francisco.]

THE INSANE, AND WHY SO MANY.

By G. A. SHURTLEFF, M. D., Superintendent Insane Asylum at Stockton.

Owing to the increase in the population of the State, and the unusually large immigration, the admissions into the Insane Asylum at Stockton during the past year have been greater than during any previous year in its history. Six hundred and sixteen patients were received during the year. The increase, however, though greater than the average, is not so great as it has been in several former years. There has been an increase of seventy-nine patients during the year. The discharges, exclusive of elopements and deaths, amount to fifty-three per cent of the number admitted, and the recoveries to forty-two per cent. The death-rate has been lower than it has been for seven years past, it being 9.83 per cent on the whole number under care.

The following summaries exhibit the number of patients in the State Insane Asylum at Stockton, California; the number of admissions, discharges, deaths, and elopements for the years ending June thirtieth, eighteen hundred and seventy-four and June thirtieth, eighteen hundred and seventy-five:

	Males.	Females.	Totals.
Number of patients July 1st, 1873	832	324	1,156
Number admitted during the year	386	138	524
Number under care and treatment	1,218	462	1,680
Number discharged, recovered	158	51	209
Number discharged, improved	29	11	40
Number discharged, unimproved	3	3	6
Number died	136	42	178
Number eloped	23	....	23
Discharged, died, and eloped	349	107	456
Number of patients July 1st, 1874	869	355	1,224
Number admitted during the year	447	168	615
Number under care and treatment	1,316	523	1,839
Number discharged, recovered	192	66	258
Number discharged, improved	33	30	63
Number discharged, unimproved	5	3	8
Number died	136	45	181
Number eloped	26	....	26
Discharged, died, and eloped	392	144	536
Number of patients July 1st, 1875	924	379	1,303

The institution is crowded inhumanly. More than six hundred patients have been received since relief on the plan adopted for its early realization by the projectors of a new asylum, was to have been had. On this account the patients have suffered inexpressibly for room, as the whole body of officers and employés have in extra work, embarrassment, and anxiety. Fortunately there has been no endemic or general sickness; but on the contrary, remarkable healthfulness has prevailed. Such a violation of an established law of hygiene with impunity, can only be accounted for in the advantages of a climate so mild and equable that the outdoor air may be allowed to sweep freely through the apartments at all seasons, night and day, without discomfort or injury.

The prevalence of insanity in California has led many to suppose that our climate has some direct influence in its production. There is no foundation, in fact, for such a belief. It is true that upon those parts of the earth's surface most favorable to the development of man's energies, to intellectual activity and advancement, insanity will be found in the largest proportion. This is not from the direct effect of climate, but on account of the more artificial and complex mode of life, and the greater strain to which the mind is subjected in an enterprising and progressive population. Our climate, from its agreeable temperature, and healthful and invigorating influence, is conducive to a full share of that mental activity and effort found in the world's great belt of intellectual development and progress.

It is the struggle for equality or supremacy in all the innumerable pursuits of civilized life, which puts the mind to a test in which the defective are likely to fail. Before the period of active progress in California which followed the gold discovery of eighteen hundred and forty-eight, insanity was unknown, though the missionary settlements had then existed more than three quarters of a century, and though there was, prior to the gold-seeking immigration, a population estimated at fifteen thousand, of European extraction. At the present day the same number of people, according to the ratio of insanity to the general population, would furnish the insane asylum with thirty patients. In eighteen hundred and fifty-two, when all the insane of the State were placed in the hospital at Stockton, out of the one hundred and twenty-four sent there during that year, only three were natives of California. During the seventy-five years already referred to of the partial settlement of this country by the Spanish-Americans, and other white races, not only was no insanity developed by the climate, but no predisposition to it seems to have been established. After the exciting causes had been in most active operation for four years, and had completely changed the habits, chief pursuits, and the government of this pastoral people, there was only one insane person to five thousand of the native class, while of the recent immigration there was, at the same date, already one insane person to two thousand of population of the same class.

The shock of transplantation, separation from family and friends, disappointments, disastrous enterprises, sudden reverses of fortune, intemperance, fast living, and an unsettled condition of life, are the chief causes of mental disorder on the Pacific Coast. These causes, or most of them, are much more rife in a rapidly increasing population, receiving large accessions annually from the influx of a very distant emigration, than in a more stationary community, whose growth is natural, and proceeds mainly from the multiplication of its own offspring.

It is a serious undertaking for a family, uncertain of sufficient means and anxious of the result, to break up an old home, with all its local attachments and endeared associations, and remove three thousand miles away—so far that distance bars return. Add to the effect of this the probable disappointment and dissatisfaction in establishing a new one, and we have produced on the mind what I have termed the shock of transplantation. Hence there has always been in the foreign immigration of all the States, a large ratio of insanity. In California we have not only a large population of foreign birth undergoing these changes and trials, but our domestic immigration, coming from remote parts and various climes, suffers similar trials and results.

But in addition to these causes of insanity in California, there are peculiar circumstances of location, which give her a great number of insane annually who do not legitimately belong to her. Once committed to the asylum, however, they are counted as her own; and, owing to the remoteness of the places to which they properly belong, they become fixed here for life unless they recover.

Central California, or more exactly our metropolitan city, is situated at the great western gate of the world's travel and commerce, where people, from east and west, converge and rest on their long journeys. This passing throng, the countless numbers floating on the Pacific Ocean, under every flag, from Arctic to Antarctic, and the sojourners upon her remotest islands, all produce their quota of insanity, much of which finds its most available refuge in our State Insane Asylum. Produced by such abundant exciting causes within its own limits, and a place of refuge for so many from without, the great number of insane in California is an inevitable consequence of its mode of settlement, the habits and condition of its inhabitants, and its peculiar situation—isolated and remote, yet in the thoroughfare of travel and commerce.

Again, we have in our State a great many unfortunate persons classed and enumerated as insane, who, in many other States and countries, would not be counted as such. There is no general provision made, by either the State or the counties, for those who are simply incapable of taking care of themselves, or are harmless in disposition and intent, and are yet irresponsible from sheer lack of mind, or from mental weakness. The maintenance and care of the insane, at the State Insane Asylum, is not a municipal or county charge, to be paid by the city or county from which the patient is sent. The consequence is, that nearly every form of mental infirmity and impairment, in persons who are indigent and become burdensome, is called insanity, and the subjects thereof are committed to the Insane Asylum. Hence we have counted as insane mere simpletons, epileptics who are simply troublesome, senile dements, methomaniacs, and so forth. Take from the insane these classes, who in Europe and the older States would be provided for in more appropriate and other public institutions than hospitals for the insane, and the sum total of insanity now ascribed to California would be materially reduced.

There is nothing which presents insanity in such startling proportions as a full enumeration of all its subjects, and an effort to provide for them all at public expense. Twenty years ago, when Massachusetts undertook this proceeding, faithfully accomplishing the first part of it but failing in the latter, there were found within her borders one insane person to every four hundred and fifteen of the general population, and many more unprovided for than were maintained, or could be accommodated, in her institutions established specially for their care.

"In the short period of nineteen years the estimated proportion of the insane in England rose from one in seven thousand three hundred to one in seven hundred and sixty-nine"—a difference of more than nine hundred per cent—produced, not by an increase in the ratio of insanity, but by a better knowledge of the extent of its existence. Dr. Bucknell estimates that in England and Wales there is one insane or idiotic person to every three hundred of the population.

The insane of our State are presented in an unprecedentedly conspicuous light, from their number being known, from the custom of publishing their commitments to the asylum, and from provision being made for the care of all of them by the State.

The insane of the State, including idiotics (of whom there are but few), and every species of mental unsoundness, number about fourteen hundred, and the population of the State is estimated at seven hundred thousand. This gives one insane person to every five hundred of the general population. We may calculate on this ratio for an indefinite period to come. Thus it is seen that an increase of one hundred thousand to our general population will be accompanied with an addition of two hundred to our insane population.

Of the fourteen hundred insane persons, or persons of unsound mind, in the State, upwards of thirteen hundred are in the Insane Asylum at Stockton. The balance is made up of such mild cases of mental impairment or defect as are taken care of at home by their friends, from choice, or do not require isolation.

NEW STATE INSANE ASYLUM, AT NAPA.

Office of California State Board of Health,
Sacramento (Cal.), July 30th, 1875.

Ed. Bentley, M. D.,
Superintendent Napa State Insane Asylum:

Dear Sir: I am informed, through a communication received for publication in the Biennial Report of the State Board of Health, from Dr. Shurtleff, Superintendent, that the State Insane Asylum at Stockton is inhumanly crowded. "On this account the patients have suffered inexpressibly for room, as the whole body of officers and employés have in extra work, embarrassment, and anxiety."

Will you be kind enough to report at your earliest convenience, so that our legislators may act advisedly, as to the progress of the building of the new asylum at Napa, and how soon, in your opinion, it can be made available for the relief of the asylum at Stockton.

Also, it is desirable to know whether the Directors of the Napa Asylum have secured the water privilege, conformably with a bond that was to have been entered into with Nathan Coombs, proprietor.

In my report to Governor Booth, in eighteen hundred and seventy-two, when deciding on the site of the Napa Asylum, I urged the necessity of purchasing more land, and especially that portion of the tract encompassing the mountain brook from which the water supply is to be obtained. Has the suggestion been acted upon; and if so, what is the result?

An early response, as my report is now ready for the State Printer, is respectfully solicited.

Yours, truly,

THOS. M. LOGAN,
Secretary State Board of Health.

San Francisco, August 6th, 1875.

Professor Thomas M. Logan, M. D.,
Secretary State Board of Health, Sacramento:

My Dear Sir: In reply to your inquiries of the thirtieth ultimo, asking when the State Insane Asylum at Napa will be able to relieve the Stockton Asylum, I have the honor to state that, in my opinion, every possible effort is being made to further the best interests of the State, in prosecuting the work on the asylum, and that the Directors have been actuated in the highest degree by the humane desire of relieving Stockton at the earliest moment; and I am happy to be able to announce

to you that the north wing is so far advanced in the process of completion that we may reasonably expect to receive patients in the latter part of the present month, and to this end every effort is now being made. I may add that the entire structure is progressing as rapidly as can be deemed consistent or desirable, when the permanency and enduring character of the work on this extensive edifice is taken into consideration.

In regard to the water supply, the contractors have availed themselves of it in various ways to great advantage in the different departments of construction, and the Directors have taken an active interest in securing and maintaining all privileges pertaining to it. I have no doubt the present supply will be ample for the working of the asylum, with a large reserve always on hand for any emergency in the reservoirs in the towers; but additional improvements are contemplated, and will be needed before its use can be appropriated to any extent for purposes of irrigation. So far as relates to the bond "that was to have been entered into with Nathan Coombs, proprietor," I am not definitely informed.

In your report to Governor Booth in eighteen hundred and seventy-two, you very properly and wisely urged the necessity of purchasing more land, and especially that portion of the tract encompassing the mountain brook. This suggestion, I regret to say, was not carried out, and the subject now, as then, commends itself to the early and earnest attention of all concerned in the best interests of the asylum.

Very respectfully,

EDWIN BENTLEY,
Medical Superintendent Napa State Insane Asylum.

SECOND REPORT ON PROBATIONARY ASYLUMS FOR THE INSANE IN LARGE CITIES.

By A. B. STOUT, M. D., San Francisco.

In accordance with the first report on this subject, submitted to the honorable Legislature of California, a bill, under the auspices of the State Board of Health, was presented for the adoption of this reform in State medicine, to that body, at its last session.

Owing to the heavy appropriations made by the State so recently, to construct an Insane Asylum at Napa, and also the very nervous state of mind of the Legislature in regard to public economy, reduction of appropriations, and increase of taxation, the bill was unfavorably reported upon by the committee it was referred to, and consequently failed to pass. The action of the committee in nowise diminished the merit of the proposition.

Constant observation and experience since the incipiency of this project of hygienic reform, have greatly contributed to increase the testimony of its expediency, its utility, and its necessity in the cause of justice and humanity.

In this view we shall renew our efforts, and present this second report, as supplementary to the first, in order to reinforce the latter with additional evidence and further argument.

A Probationary Asylum for the Insane does not imply solely an institution within which to determine and detect feigned insanity, or falsely charged insanity, and thus intercept the frauds and injuries attempted in litigation, whether in civil or criminal prosecutions. Great as would be the advantage of possessing such a check, guarded by commissioned experts in lunacy, and with legal power to inforce seclusion without sacrifice of the constitutional rights of man, it is not in this alone that the proposed establishment possesses merit.

In an extended meaning the word *probationary* signifies *tentative*, or an institution in which the effort is made to afford relief by quick and prompt intervention in the incipiency of mental disorders, and thereby prevent the disasters which so often render simple physical disorders, accompanied with mental alienations, forever incurable; and then entail the long catalogue of family calamities and the revolutions in matters of estate. We say, with confidence, that the large majority of such cases, as they now stand recorded, is the result of *neglect* not necessarily willful, but from the want of the required facilities in the incipiency of the invasion of the malady to arrest its progress. Give it no foothold, it will fail to hold possession. As things now are, parties interested, in the most loyal faith, rush around for relief, but can only find it after protracted and expensive delay. It is just in this delay that the irreparable damage is done. How perfectly would this evil be averted, could they *quickly* transport the person without delay to the provident asylum of the State. In extreme perils, it is admitted that humanity and self-defense take precedence of law and the individual right of liberty.

This last mentioned right we would be among the last to infringe, but this right has its limit. An insane man on the street menacing great harm to himself or others, would be arrested instanter, and be confined in prison, at least for a short time; but insanity being neither a crime nor a willful misdemeanor, he has only deserved confinement; not, however, in a prison, but in a hygienic place of restraint authorized by legal enactment.

No one would suppose, in the case cited, that a suit for false imprisonment would be entertained, yet suits of this character have been brought by persons confined against their protest, although insane, in private asylums, so that such institutions have become, often harmfully, guarded against whom they receive. What, now, becomes of the person thus "arrested instanter?" He is punished, virtually, though only the subject of an involuntary disease, or with hereditary reference, he is imprisoned for his father's misdemeanors. This is not all, he may pass a night in a comfortless cell, perhaps the subject of felons' curiosity or diversion; and yet the exposure, want of care, of food, of sleep, that night, might fix uncurability upon his case, which would have been cured in a few days, had he been transported "instanter" to a humane asylum, provided immediately with a comfortable bed, seclusion, but among kind friends, without disgrace, and the required food, the needed sedative, and, in last recourse, the harmless "*camisade de force.*" Yet, more, the helpless maniac is made a subject of notoriety; his name is reported in newspapers, with all the story done up, perhaps, in ridicule, to please morbid tastes; hence, for weeks, he is subject to annoyance; his family and business relations damaged, and, finally, a bill of useless expenditures; or if some mistake occur, or friends fail to appear, thirty days in the County Jail.

Now all this scene would be evaded by the alternative proposed, while the unfortunate invalid would be humanely and silently cared for without undue notoriety.

We offer this to show the importance of instant relief in cases of sudden outbreaks of insanity.

Part II.

Relief in the first stages of insanity.

There is nothing incompatible in a Probationary Asylum, as explained already, in the last biennial report, with the addition of a department for the cure of alcoholism in its first invasions, and while yet a curable disease. A Home for the Inebriate could, therefore, be annexed to the institution. There are about ten such homes in the United States, one of which, to our honor be it said, is in San Francisco. This latter is, however, a private charity, sustained by a few humanitarian individuals. The question of the intrinsic value of benevolent aid-resorts for the ills of intemperance has been largely discussed. Socialists and philanthropists have not failed, whether or not they are truly wise provisions against those "ills that flesh is heir to." It would be vain to recapitulate them here; but the result of the investigation is, that on grounds of sound social economy, as well as accordance with the dictates of Christian conscience and the general indulgence of popular sentiment, that they are not only wise and good, but indispensable. With or without comment as to how they come, delirium tremens and alcoholism are diseases,

the subjects to which have their natural claims, as members of the body politic, like those diseased from all the other objectionable irregularities of social life. A very large proportion of such cases, if early relieved, are perfectly redeemable, which now are lost by maltreatment at the outset.

Now, it is well known to medical men, if not to legislators, that inanition from want of food, and exhaustion from insomnia or want of sleep, are the symptoms most destructive and the most difficult to combat. Abundant food and rest are, therefore, the indispensable requisites. As things now go, do inebriates get this treatment? As for themselves, they repugn food, and are driven by an uncontrollable brain to inordinate physical efforts and insane mental activity. They resist what they most need. In many cases food and rest can only be procured by a force applied with method. Generally, in the cases brought for hospital treatment from the streets, from jails, from their homes, many days, often weeks, have been consumed in the various tentatives of friends or others to obtain relief, while in this very time the precious moments to administer aid escape and have flown forever.

It must be manifest that to control these exigencies in the incipiency of alcoholic insanity, the opportune moment, time, skill, and place, can only be found combined in such an institution. What has been already well said need not be rewritten; we, therefore, adopt and append to this report the three following essays on the subject. (See Documents A, B, and C.) Such valuable and disinterested testimony should be decisive evidence. It would be vain to continue further the discussion at present, as the report would become unreadable by reason of its length; hence, we commend it to your approbation.

A. B. STOUT, M. D.,
Member State Board of Health.

[*DOCUMENT A.*]

WHAT SHALL BE DONE WITH THE HABITUAL DRUNKARD?

By JAMES F. HIBBERD, M. D.

[A paper read to the Wayne County Medical Society, January 7th, 1875, in support of the resolutions attached.]

It is not the intent of this paper to discuss the general subject of intemperance, but to consider that phase of it which is denominated habitual drunkenness. And by this phrase is meant that condition of a man wherein he drinks alcoholic beverages to intoxication whenever opportunity offers. Not when opportunity incidently offers merely, but who makes opportunity when none offers otherwise. In other words, a man is an habitual drunkard when the desire for alcoholic beverages becomes his ruling passion, and the drinking of them his leading practice, and all for the sake of the intoxication they produce.

When a man has arrived at this stage of a drunkard's career, he has lost the higher characteristics of his manhood. He has lost his recognition of the dignity of his position in the scale of created beings; he has smothered his moral nature; he has drowned his sense of honor; he has dishonored the ties of consanguinity; and he has ignored his obligation to care for himself and for those dependent on the proper exercise of his physical and mental ability.

This condition is never, it is believed, a congenital one, but always the result of education or training—a condition into which the victim voluntarily enters; yet, nevertheless, one, when fairly entered, he can no more control than he can control the advent of hunger, or the necessity for sleep.

In short, under the change wrought in his mental operations through alterations induced in his physical organization by the action of alcohol, he has become irresponsible for his acts. Disease has been engendered in his body, such that it makes the healthy action of his mind impossible. And this abnormal mental activity is a species of insanity, differing widely from ordinary insanity in its cause and manifestation, but insanity nevertheless. Perhaps it would be better to regard the term insanity as generic, as it really is, and make the aberration under consideration a species, to be designated alcoholic insanity.

It can scarcely be necessary to enter into a lengthened argument to establish the fact that an habitual drunkard is insane. A very brief argument will suffice.

An insane person is defined to be one of unsound mind. A sound mind being the standard, it becomes necessary to define it, which, for our purpose, may be done by saying that a sound mind, as regards any given department of sociology, is one that approximates the average condition of the minds of all the people in a community touching the duty of an individual in that particular department.

Let us apply this principle. In this community it is the sense of a vast majority of the people that it is a man's duty to provide shelter, food, and raiment for himself and family; to contract no unreasonable obligations, and to fulfill all obligations that he enters into; to protect his own property and to respect that of others; to maintain certain social relations with his neighbors, and to live up to his religious convictions.

Now let us adduce the career of an habitual drunkard, and witness how widely he fails of fulfilling these reasonable responsibilities. There is a married man in this city, an accomplished mechanic, who always had a thrifty establishment until he became an excessive drinker of alcoholic beverages. Then his business ran down, soon utterly faded away, and he became a financial wreck. His family are in rags and insufficiently fed. He works by fits and starts for another man until he obtains some money, then gets drunk, generally has a fight or two, is arrested and fined, induces some one to go his bail, works again until he earns more money, then starts on a fresh spree. Does this man live up to his responsibilities? If not, he is insane.

Another married man allows his wife to do washing to support him and their children, and the little he earns he spends for drink, and occasionally begs, steals, or forces from her, a little of his wife's hard earnings to buy liquor with. Is he fulfilling his reasonable responsibilities according to the standard? If not, he is insane.

An unmarried man, formerly a good mechanic, with full work and plenty of money, is now supported by his brother. He is so devoted to gratifying his love for drink, and so lost to his once high sense of honor and honesty, that if his brother gives him money to buy a pound of butter for the family, he will buy whisky with the money, and return drunk without the butter. Is this man's conduct up to the average of the community in which he lives? If not, he is insane.

Another unmarried man, twenty-five years old, with many accomplishments of manners and mind, lives on his father's bounty, and his sprees are so frequent, and in them he is so violent, that the whole family are in a state of perpetual terror, and are, by his bad conduct, wholly unfitted for the high social duties that their wealth and education would otherwise so admirably fit them for. The father has spent thousands of dollars to repair damages done to property, person, and character by this erring son in his drunken rage. Is this son up to our standard? If not, he is insane.

But is it needful to recite more examples? If the premises laid down be correct, does not every sound mind know of many, alas! too many unsound ones of this particular class. Where is the blood in human vessels that does not have kindred blood coursing through crazy brains—brains that would honor their possessor and his kind, if it were not for the undue ascendency of the fiery king that beguiles and destroys?

We therefore conclude that every man who drinks an excess of alcohol loses his normality, and the most notable feature of this loss is the unsound condition of his mental faculties, and this unsoundness is of the nature of a special phase of insanity.

The resolutions propose to confine a man who is thus insane. Do you ask what right has any man or any number of men to rob a fellow citizen of his liberty? That is the point. We will address ourselves to its consideration for a few moments. Only two adequate reasons can be assigned for such an act; first, to benefit the subject of the restraint, and, second, to protect the community.

But let us for the nonce lay aside the consideration of alcoholic insanity, and in a few sentences review the general relations of society to persons who are esteemed so abnormal as to make it proper, in behalf of the common weal, to deprive them of their liberty, and then apply the deductions that result from the review to the case in hand.

Self-preservation is a great law of nature, and it is just as imperative in a community as in an individual. When any member of a community becomes a source of danger to the common or individual welfare, it is not only the privilege, but it is the bounden duty of such community, through regulations established for that purpose, to interfere and restrain the man. If the danger that attaches to him be from criminal intent, he should be restrained and punished, and reformed, if possible. If the danger arise from disease of a contagious character, he should be restrained and isolated, and restored to health, if possible. If the danger grow out of maniacal fury, he should be confined and treated in an institution specially organized for the management of that form of disease. Suppose it be granted that a man is insane, that is not of itself sufficient to warrant the public authorities to take charge of him so long as he is harmless toward the person and property of others, and has friends who care for him. True, every recently crazy man is considered a fit subject for restorative treatment, and the State at large has provided the place and means for such treatment, of which the friends of the insane may avail themselves, if they choose. But the authorities will not originate measures for arrest and confinement of the insane, unless he be dangerous in some way. This is not a new doctrine. In fact, it is a part of the provisions of existing organizations in every civilized community. Do we not see how constantly criminals are convicted and punished, and that they are sometimes reformed? Do we not see how quickly the authorities will take charge of a man who has the smallpox, or the cholera, and this solely to protect the public against the infection of a contagious disease? And do we not frequently witness the legal inquiry into a man's alleged insanity, and if the inquisition declare him insane, see him sent off to the hospital for treatment? Sometimes these proceedings on behalf of the insane are set on foot in the hope of a cure solely. Sometimes they are inaugurated for the purpose of putting one under restraint whose insanity is of a character to make him dangerous to the persons about him, or to their property.

By operation of the law, as it now stands, if a man commit crime he is punished; if he be dangerously insane he is sent to the hospital for treatment. But if a man be sane, when not under the influence of alcohol, on all subjects except that of drinking, he is not, by the law, held to be insane, albeit he has no power to refrain from drinking, and when drunk is a raving maniac. What is wanted now is a law that will recognize habitual drunkenness as a disease—a species of insanity, in fact, that both the subject's best interest and the general welfare requires should be adequately treated. But as it cannot be properly treated in private houses, the law should, therefore, also provide public institutions for the relief of these otherwise hopelessly ruined citizens, and while restoring the victim of disease to health, would, at the same time, save the public from the consequences of his insane depravity.

A law, however, which is not sustained by public opinion, cannot be maintained in activity for any considerable time; and public opinion will not sustain any enactment that is not in accord with the general sense of right and justice; and the general sense of right and justice will not, and ought not, to sanction the depriving any man of his

liberty, until it be clear that such restraint is the best, if not the only means of preventing great private and public wrong.

It is my opinion that the public head and heart are ready to see that habitual drunkenness is a species of insanity that can be successfully managed only in institutions specially organized for, and adapted to, the end in view. But this function of the public head and heart lies dormant in a great measure, and to make it available for the good end, it must be aroused into active, aggressive life. And to me it seems quite clear that physicians are the leaven that must start the fermentation in the whole mass of the public, which, when fairly leavened throughout, will see as with one eye, and move as if touched by a common inspiration, to establish and maintain the truth, as herein indicated, in an efficient and active manner. Therefore, I ask a vote of approval by this society of physicians, to-day, of the sentiment expressed in the resolutions before it, that we may here and now put this ball in motion, with, on my part, a full hope and an abiding faith that it will roll on until the ideas herein presented shall prevail over the land, and the measures herein indicated shall be put into active operation, and prove the blessed means of curing thousands of men of alcoholic insanity, and saving still more thousands from becoming insane. For, in my judgment, this, or a related plan, which shall hold men to an individual responsibility, offers the only possible means of checking the widespread tendency to the excessive use of alcoholic beverages.

The love of personal freedom, and of the widest liberty of action, is so strong in the American citizen that it will be only an occasional one who will pursue a course of indulgence in an appetite that he knows will inevitably lead him into an insanity for the cure of which he will be incarcerated, and compelled to labor without the liberty to determine the time or character of his work. Perhaps for the people in other countries, the plan under consideration might be futile; but for the people in America, if I do not misread them, you can touch but few chords more sensitive than the desire to drink as often and as much as they please, and one of these is the love of personal liberty and independence.

An affirmative vote on the resolutions, of course, is intended only to have the force of the expressed sentiments of the society on the principle involved. When public sentiment is ripe for the inauguration of institutions to put these principles into active operation, it will not be difficult to draw up plans and specifications that will convince all reasonable people of their practicability, and that the maintenance of them will be no expense to the public at large; that they will sustain themselves, and have a large surplus for the benefit of whoever may be rightfully entitled to the product of the talent and labor of the subjects of this restorative discipline.

RESOLUTIONS.

Resolved, By the Wayne County (Indiana) Medical Society: 1. That it is the sense of this society that persons who drink alcoholic beverages to intoxication constantly, or frequently, and while intoxicated waste the means of living for themselves or others, or abuse themselves or others, should be held to be of unsound mind.

2. That a suitable name for this aberration of mind is "Alcoholic Insanity."

3. That alcoholic insanity being a special form of disordered intel-

lect, arising out of a specific cause, should be treated in institutions specially prepared for, and strictly confined to, this one class of patients.

4. That institutions for this purpose should have three leading characteristics, to wit: first, restraint; second, proper regimen; third, profitable industry.

These resolutions were unanimously adopted and ordered to be published.

[*DOCUMENT B.*]

DELIRIUM TREMENS.

By DANIEL H. KITCHEN, M. D., Chief of Staff, Charity, Fever, and Smallpox Hospitals, etc., New York.

The mental and physical derangements arising from the use, or rather abuse, of alcoholic liquors, are so numerous and variable in their forms and phases, as to cause considerable confusion even among the most eminent psychological and medical experts. The forms most definitely known and understood on this and the European continents, are called alcoholism and delirium tremens, which are separate diseases, and present invariably distinct symptoms; variation, whenever it does occur, being within certain well known limits, precluding the possibility of mistake.

It is an error with some writers to describe delirium tremens as a mania of or arising from intoxication, thereby confounding it with what is recognized as alcoholism. Dr. Ray remarks that "it may be the immediate effect of an excess, or a series of excesses, in those who are not habitually intemperate, as well as those who are; but it most commonly occurs to habitual drinkers after a few days total abstinence from spirituous liquors. It is also very liable to occur to this latter class when laboring under other diseases, or suffering from severe external injuries that give rise to any degree of constitutional disturbance." As regards general temporary incapacity, delirium tremens exercises just the same influence in the total destruction of moral and intellectual responsibility as delirium or insanity from other causes.

Wharton and Stillé, in their Medical Jurisprudence, say that "delirium tremens is not the intended result of drink in the same way that drunkenness is." It is the result of prior vicious indulgences, but differs from intoxication in being shunned rather than courted by the patient, and of being incapable of voluntary assumption for the purpose of covering guilt. That the person under the influence of delirium tremens is mentally, morally, and legally irresponsible for acts done during the paroxysm, is now universally conceded, both within and without the pale of civil and criminal tribunals.

In the case of United States v. Clarke, the earliest case of the kind on record, the Court charged the jury that if they "should be satisfied by the evidence that the prisoner, at the time of committing the act charged in the indictment, was in such a state of mental insanity, not produced by the *immediate* effects of intoxicating drinks, as not to have been conscious of the moral turpitude of the act, they should find him not guilty." Justice Hoy, also, in the great American case, declared criminal responsibility not to attach where the delirium is the "remote consequence" of voluntary intoxication, "superinduced by the antecedent exhaustion of the party, arising from gross and habitual drunkenness." "However criminal, in a moral point of view, such an indulgence is,

and however justly he may be responsible for his acts arising from it, to Almighty God, human tribunals are generally restricted from punishing them, since they are not the acts of a reasonable being. Had the crime been committed when Drew (the defendant) was in a fit of intoxication, he would have been liable to be convicted of murder. As he was not then intoxicated, but merely insane from an abstinence from liquor, he cannot be pronounced guilty of the offense. The law looks to the immediate, not to the remote cause." In another recent case, a Federal Judge, of high authority, told the jury that if the defendant was so far insane as not to know the nature of the act, nor whether it was wrong or not, he is not punishable, although such delirium tremens is produced by the voluntary use of intoxicating liquors.

The following graphic delineation of the distinction between delirium tremens and insanity has been given by Justice Holroyd, of the English Bench, in John Burrough's case (1 Lewin, C. C., 75), and is also universally acknowledged as good law in the United States Courts. He says: "Drunkenness is not insanity, nor does it answer to what is termed an unsound mind, unless the derangement which it causes becomes fixed and continued by the drunkenness being habitual, and thereby rendering the party incapable of distinguishing between right and wrong."

As early as the year eighteen hundred and twenty, Tiedeman, Gmelin, and Majendie made some interesting and important investigations as to the poisonous nature of alcohol and its influence upon the blood and the system generally, detecting the presence of alcohol in the blood by its odor; and Sir A. Carlisle subsequently observed that the fluid found in the ventricles of the brain of drunkards had the smell, taste, and inflammability of gin. These inquiries and deductions naturally led the way to the determination of the pathology and distinctive symptoms of alcoholic poisoning, drunkenness, and delirium tremens arising from the excessive use of alcoholic liquors, and to the establishment of a definite differential diagnosis in reference to these diseases.

Leoville, in the year eighteen hundred and twenty-eight, was the first to promulgate the theory that delirium tremens could be distinguished by an exalted condition of the "vital powers of the brain, excited by molecules saturated with alcohol absorbed from the surface of the stomach and bowels, and carried into the current of the circulation." Recent researches, however, have established beyond dispute, by experiment and by daily experience, that the alcohol is instantaneously absorbed into the circulation, and operates as a direct poison on the nervous tissue through which the infected blood circulates.

As an inevitable consequence, the peculiar odor of alcohol impregnates the breath and permeates even the pores of the body, and imparts a pungent, spirituous aroma to the clothing. Post mortem analyses have revealed the presence of alcohol in the blood, the urine, the bile, the fluid of the serous membranes, the brain, and the liver.

Dr. Percy made some experiments, specially with relation to the rapid action of alcohol on the circulation. He injected strong alcohol (about ten degrees under proof) into the stomachs of two dogs, and scarcely two minutes after the injection all respiratory and cardiac movements ceased, and on autopsy, the stomach was found nearly empty and the blood highly charged with alcohol.

The combined testimony of French, British, German, and American physicians proves that in that state in which the system is peculiarly susceptible to delirium tremens, the blood is surcharged with unchanged and unused material, and contains at least thirty per cent more of car-

bon than in the normal state. The order of events by which this condition is brought about may be thus stated: The alcohol is immediately absorbed by the blood vessels, without change or decomposition. A portion of it is slowly eliminated by the lungs, liver, and kidneys, as alcohol simply, a portion remaining in the brain, liver, muscles, etc., for a time, undecomposed. The products of the decomposition, by absorption of the free oxygen of the blood, are water, acetic acid, and carbonic acid. The oxygen being thus diverted from its legitimate function, the exhalation of carbonic acid through the lungs is materially diminished, and the health correspondingly endangered by the lessened excretion of urea and uric acid. The presence of alcohol in such undue proportions is, beyond all doubt, the primary agent in the retention of this uneliminated matter; and the consequent impairment of health is intensified to a still greater degree by the increased frequency of functional acts, and subsequent depression thereby produced, due to the stimulant action of the alcohol.

The tissues generally atrophy, and while a particle of alcohol remains in the blood in its normal condition, it exercises a toxic or poisonous effect upon the whole nervous system through which the poisoned blood circulates. Hence, if a constant supply of alcohol be kept up, the alcoholism becomes permanent or chronic, and a series of acute paroxysms, usually in the form of delirium tremens, supervene; though occasionally, if the degeneration of the vital organs becomes excessive, fatal results ensue from asthenia or typhoid symptoms, accompanied by coma.

One of the chief and most essential elements in the causation of delirium tremens is the poisoning of the nerve-substance of the entire system, and more especially that of the brain. These effects produced on the cerebrum and medulla oblongata are repeated in the lungs, a constant sympathy existing between these organs. The accelerated motion and fevered condition of the blood, which is incessantly kept up in the case of the habitual drinker, is especially manifested by certain cerebral, thoracic, and other general phenomena in the loss of cerebral power, evinced by the absence of control over thoughts, emotions, and muscular action; the feeble and rapid action of the heart, the involuntary tremor and weakness of the muscles, and the mental agitation and terror which are ever on the increase. Should the patient eventually recover from these paroxysms, subsequent indulgence in similar excesses entails upon him, not only a persistent susceptibility to a recurrence of these phenomena, but inevitably and irrevocably gives rise to a permanent degeneration of all his physical and mental faculties, with a train of ills, such as cachexia, emaciation, marasmus, sexual incompetency, delirium, suicidal melancholy, permanent psychical aberration, and such like morbid phenomena, ending not unfrequently in epileptiform seizures, idiocy, or general paralysis.

And here a highly important consideration occurs to our mind, which has long been a subject of controversy, but has now received a tolerably decisive and reliable solution, viz: the transmission of this morbid appetite for intoxicating drinks from one generation to another, and the inheritance, by the drunkard's progeny, of the long and fearful catalogue of alcoholic sequelæ, in a chronic form. Morel, Whitehead, Adams, and other eminent authorities, affirm that the vice of alcoholic abuse is not only hereditarily transmissible, but that it also leads to congenital idiocy, or insanity, in even the third and fourth generation, and, furthermore, that in cases where the tendency to alcoholic excesses has an

hereditary origin, cure is, as a rule, impossible. Morel cites, as an example, a family that came under his own professional notice, in which the great-grandfather was a confirmed drunkard, and so marked and complete was the transmission of the disorder, that the race became totally extinct, under the recognized phenomena of alcoholic poisoning and degeneracy.

MORTALITY.

Some interesting and accurate statistics as to the mortality of the disease, and its relative frequency among either sex, have appeared in the British Army Reports, and afford valuable data for prognosis, while the facts there detailed are pregnant with suggestions as to the course which social reformers and philanthropists should take in arresting its progress. The report for eighteen hundred and fifty-three (prepared by Sir Alexander Tulloch), gives the undermentioned percentages of the mortality from delirium tremens in the home service (consisting of about seventy-eight thousand men), and the chief depots in the colonies (say about forty thousand troops), excepting India, which, for obvious reasons, we shall consider separately. We would remark, *en passant*, that, on investigation of the reports of the last twenty years, no perceptible change in the ratio has occurred, and these calculations may therefore be considered an accurate transcript of the mortality at the present period:

	Per cent.
Great Britain, infantry	17.6
Great Britain, cavalry	13.8
Bermuda	15.0
Canada	7.94
Gibralter	13.6
Malta	8.8
Nova Scotia	9.1
United States	8.0

The report and statistics furnished by the medical authorities at the General Hospital in Calcutta, and the Medical College Hospital, relating to and gathered from the records of five consecutive years, reveal the following facts:

1. That the disease occurs in women and men in the proportion of one to twenty-five, due rather to difference of habits than of sex.
2. That no evidence has been given to warrant us in asserting that the season of the year has any definite influence on the occurrence of the disease, though the mortality shows a marked augmentation during the eight hot months, the number of deaths being more than double the proportion occurring in the four cold months. These facts are borne out by our own experience in this hospital.

The accompanying table will show that the greatest mortality occurs between the ages of twenty-five and forty (a fact which is corroborated by the statistics of our delirium tremens wards), and also evidences that there is no uniformity in the proportion of deaths to the number of cases.

3. That in regard to age, the ratio is as follows:

Age.	Cases.	Deaths.	Per cent of deaths.
20 to 25	34	4	9.1
25 to 30	66	16	24.2
30 to 35	48	11	22.9
35 to 40	76	7	9.2
40 to 45	62	6	9.6
45 to 50	23	4	17.3
50 to 60	7	...	......
60 to 65	5	1	......

In delirium tremens the chief elements to be considered in the prognosis, are the absence or occurrence of sleep before the patient becomes exhausted, the character of the sphygmographic record of the pulse movements, and the introduction of an adequate amount of nourishment into the system. It has never been advanced or seriously believed that sleep is, in itself, curative. The disease has a certain course to run, its longer or shorter duration resting simply on its original virulence, the strength of the patient's constitution, and the degree of nutrition and support rendered by the regular and frequent supply of well selected food. In the case of an extremely hard drinker, or the complication of pneumonia, the chances of recovery are materially diminished. A first attack is much less dangerous, much less likely to culminate fatally, than a second, third, or fourth attack; but there are, of course, important exceptions and qualifications to this law, which can only be discovered by careful diagnosis. For example, a man of middle age, suffering under a first attack of delirium tremens, whose nervous system has been much enfeebled by chronic disease, or an insufficiency of feeding, but who has never, until recently, indulged to excess in drink, is extremely likely to succumb to the first attack. The fact that his system has been run down by mental anxiety and want of food, and that the eliminating organs (the kidneys especially), are unused to the duty of excreting large quantities of unchanged alcohol, render his recovery extremely improbable; whereas, on the other hand, a young man (a young sailor, for instance), whose first debauch has induced delirium tremens, may, from the inherent strength of his constitution, survive not only one, but two or three similar visitations.

SYMPTOMS AND COURSE.

The period of actual commencement, and the premonitory symptoms of this disease, have been points of controversy for many years. Dr. Lairdner denies that the proximate cause is the sudden withdrawal of potations, and affirms that it is the immediate product of a protracted debauch. The opposing theory simply asserts that a voluntary abstinence from alcoholic stimulants of some two or three days, precedes an attack of delirium tremens, and that the combined influence of the sudden withdrawal of alcoholic stimulants, and the absorbed alcohol remaining in the system, produces the catastrophe known as delirium tremens. To this latter opinion we subscribe, for there are many who are constantly taking small quantities of spirits, and who, though they

never become unconscious from its intoxication, considerably exceed their accustomed allowance, and continue in that course. The symptoms of delirium tremens generally occur in these persons from the second to the eighth or ninth day after a protracted debauch, and the premonitory symptoms are not unfrequently lost sight of.

The usual course may be thus described: The first warning of its approach is given by an attack of complete insomnia. Some pathologists divide the subsequent symptoms into several stages, but without apparent reason other than their individual tastes. The succession of symptoms after the premonitory insomnia, is usually in this order. The pulse is peculiarly slow and feeble, the hands and feet are cold and clammy, there is profuse sweating, with great disability, and nausea and vomiting in the morning. Anything which affects the mind or spirits produces a tremulous agitation. In vain the sufferer wooes sleep, it has fled from him. At the best, his slumbers are short and fitful snatches, broken in upon by visions and hallucinations of the most horrifying character. If he close his eyes but for a moment, he is relentlessly pursued by these phantom visitants; and even in broad daylight, with his eyes wide open, these creatures of his disordered imagination surround him on every side. During all this time there is so complete an absence of appetite in most cases, that little if any food is taken, a circumstance that contributes materially to the intensity of the disease. And now the anxiety and nervousness is exchanged for incoherence of speech and wild excitability of manner, sometimes evidencing itself in causeless anger, or in great terror at the terrific forms which people the chamber, and which he is continually endeavoring to push aside with his hands. He talks incessantly in a rambling manner. His pulse is quickened from one hundred to one hundred and thirty or one hundred and forty per minute; it is sometimes small and thready, occasionally soft and voluminous; and the form of the pulse waves closely resemble those in fevers of a typhoid type. Muscular tremor, from which the disease derives its name of *delirium tremens*, is by no means universally present. Craigie affirms that it is ever present, in cases of confirmed dram-drinkers, but in point of fact, it is only an exaggeration of the chronic tremors of the extremities, which are the inevitable penalty of hard drinking. But even in the absence of this muscular tremor, there is a constant restlessness, the patient shifts restlessly in the bed, constantly getting out if permitted. The pupils of the eyes are dilated, and in constant rolling movement. The temporal and carotid arteries throb violently, sometimes the face is flushed, but more often deadly pale. The tongue is tremulous, and protruded jerkily, is ordinarily covered with a yellowish fur, though sometimes it is clean, red, and glassy, or again, brown, dry, and cracked. After this state of things has continued for three or four days, the patient passes into a drowsy condition, from which he awakens to a state of comparative convalescence, or, in the event of adverse complications, with an augmentation of the delirium. In other cases, the patient, in the midst of violent delirium, with great excitability, suddenly collapses; the pulse becomes hurried, intermittent, and thready, the features pinched and ghastly, the breathing gasping, and death speedily ensues.

The stage of convalescence, once established, presents nothing particularly requiring description. Should a relapse, however, occur, he passes into a comatose condition, with muttering delirium, eyes open, staring, and fixed; the restless movement of the limbs more distinctly

marked; picking at the bedclothes; or, possibly, a profound, stertorous coma, or violent convulsions, which close the scene.

GENERAL SUMMARY OF SYMPTOMS.

Acute delirium and incoherence; stupor; strong suicidal impulse; hallucinations; dread; tremors of the tendons and muscles of the hands and limbs; watchfulness; absence of sleep; great frequency of pulse, one hundred to one hundred and forty per minute. Form of pulse waves resemble fevers of the typhoid type; furred condition of the tongue; cool, humid, or perspiring surface of the skin; saccharo-alcoholic odor; face flushed, or deadly pale, are the general phenomena. Slight tremor or faltering of hands and knees; tremulousness of voice; unaccountable and indescribable restlessness; sense of anxiety and presentiment; disturbed sleep; and loss of appetite. These symptoms generally occur after a sudden abstinence from liquors, and last for three or four days, when the patient ceases to sleep altogether. The above mentioned symptoms increase in severity, and delirium supervenes, at first only during the night, but gradually becoming constant, and necessarily the most prominent feature of the disease. The delirium, which is especially characterized by watchfulness, hallucination, terror, and apprehensive dread, lasts from three to six days, during which period the imagination of the patient conjures up the most horrible phantoms and visions; his countenance indicates unutterable anguish of mind and physical pain, and in the hope of escaping from his imaginary tormentors, he often endeavors by acts of violence to take his own life, and that of the persons within his reach.

TERMINATION.

After a time, sleep occurs (that is from three to six days from the period of attack); at first it is broken, then followed by a profound sleep of six or eight hours duration, from which the patient awakes improved.

TREATMENT.

In the treatment of delirium tremens, many points are to be taken into consideration, as the condition of the patient, the length of time the delirium has lasted, and the surroundings of the patient.

Our custom is to place this class of cases in a large room, well ventilated, with about one thousand cubic feet of space for each patient.

Usually the patient is much fatigued on admission, and is in feeble physical health, and not infrequently there are complication, as bronchitis or pneumonia, and occasionally Bright's disease.

When no complication exists, we give a tepid bath. The patient is put to bed, and usually a *camisade* is required to restrain him.

The usual, and, perhaps, better treatment, is at once to place the patient on liberal and nutritious diet, as beef juice, cream, or essence, soups, milk, milk punch, egg-nog, etc.

If he is feeble, the reasons for giving stimulants are plain, though the delirium is caused by the same stimulant. Some recommend pure alcohol to be given instead of brandy, whisky, or even wine.

Of course, in administering stimulants to this class of patients, great and watchful care should always be exercised. The pulse is a safe guide, as stimulants should lower it and give it fullness. To quiet the tremors and restlessness, opium serves a good purpose, administered by hypodermic injection.

The treatment which in all probability is the most effective, is a generous diet, full doses of fluid extract of conium during the day, to control the muscular action, and during the evening, hydrate of chloral, with tincture of hyoscyamus, the latter to be repeated until sleep is secured.

[*DOCUMENT C.*]

HOSPITALS FOR INEBRIATES.

Ten of these asylums already exist, some of which have been in operation for several years. Of these the principal are: 1. That at Media, near Philadelphia, opened about seven years ago, and containing twenty-five inmates. 2 The New York State Inebriate Asylum, Binghamton, opened about nine years ago, now capable of containing eighty individuals, but about to be opened for the reception of two hundred. 3. Washingtonian House, Boston, containing twenty-four patients. 4. Shore Sound. 5. Ward Island. There are several others, at Chicago, Maryland, San Francisco, etc. In eighteen hundred and seventy-one, the grand total of admissions to some of these asylums amounted to five thousand nine hundred and fifty-nine. Into these establishments inebriates are admitted, either on committal by a magistrate for a specific period; after a process of examination before a Judge, and a jury summoned by him, the alleged drunkard being present, and being adjudged as requiring a curator and confinement; or on their own voluntary application and submission to existing rules and regulations. Of the total quoted, two hundred and fourteen, or nearly four per cent, come under the first category; one hundred and forty-four, or between two and three per cent, under the second; and five thousand five hundred and fifteen, or ninety-four per cent, under the third. It bears intimately upon the permanent efficacy of the measures pursued, that of the same number, one thousand three hundred and five, or twenty-three per cent, were admitted once; two hundred and twenty-seven, or nearly four per cent, were readmitted twice; ninety-seven, or nearly two per cent, were readmitted thrice. These Sanitaria, as they are gingerly called, are almost all under the superintendence of medical men, some of whom trust considerably to the employment of drugs during the collapse and excitement which follow excessive or prolonged drinking, and during the convalescence or reconstruction of the tissues of the body, to which much importance is attached; but none of them claim for any therapeutic agent the power of eradicating the habit or tendency, or of curing the disease originating therein. Great reliance is placed in the moral means brought to bear during seclusion, upon exercise, games, occupation in the surrounding grounds or country, in reading, writing, composition, social recreation, and the reciprocal influence of different dispositions associated together; and finally upon a nutritious diet, for it is affirmed that all great drinkers are also great eaters. These places have more the character of well conducted club houses, with a medical director, than of hospitals. After a brief probation, great confidence is reposed in the penitents, and much liberty allowed to them; certain of their number are intrusted with money, permitted to visit different parts of the country, and to mingle in society, as a test of their self control; certain others pursue their ordinary business in adjoining towns, but are held to be amenable to the rules and regimen of the hospital. As might have been predicated, from the experience of such classes obtained

in this country, these privileges are occasionally abused, though less frequently than might have been expected. Stimulants have been conveyed within the sacred precincts, it has become necessary to lock up individuals excited by their unhealthy craving, and it was proposed, in consequence of irregularities and disturbance in one house, to swear in the servants as constables. But, after making all deductions, what, it may be inquired, are the results claimed by those who have conducted this experiment? It should be premised that the authors whose works have supplied us with information, regard either the subsidence of the paroxysm of ebriosity, or such subsidence followed by a period of lucidity and temperance, characterized by convictions of the evil and danger, and degradation of relapse, and by a determination to avoid or resist temptation as a cure of the disease. This lucid interval varies in the opinion of different observers from days to weeks, months, years. The most modest estimate of the curability of drunkenness or dipsomania, for these are not distinguished, is that thirty-four or thirty-five per cent of those subjected to treatment are restored to permanent health. This is given on the authority of Drs. Parrish and Dodge, but fifty, sixty, even ninety per cent cures are claimed as crowning the labors of other physicians; or to place the statistics in another form, of two hundred and fifty-six patients received from October first, eighteen hundred and seventy-one, to eighteen hundred and seventy-two, into the Binghamton Asylum, one hundred and ninety-eight were discharged with great hopes of a permanent reformation, and fifty-eight unimproved; of two hundred and seventy-eight patients admitted into the Pennsylvania Sanitarium, in the same period, ninety were cured, one hundred and thirty improved, and thirty-five were regarded as incurable; of fifty-four patients admitted into the Maryland Asylum, at Baltimore, forty were discharged as having received benefit, ten as having received decided benefit; and of three thousand three hundred and twenty-two that have been received into the Washingtonian House since its commencement, "we have the satisfaction of knowing that a large proportion of them have become permanently reformed, have regained their former position, and become again exemplary members of society." This is not the place to expose the fallacy of the standard of cure here employed, further than to mention the irreconcilable discrepancy between the results recorded and those observed in this country, or to suggest the difficulty which must be experienced in tracing out the subsequent deportment of discharged patients, or to show how fugacious must be the change effected, further than to quote from the reports of the Maryland Asylum, that fourteen patients were admitted once, eight twice, and two three times, with an average of only two months' interval between each attack. Nor is it necessary to insist upon the opinion of eminent psychologists, such as Drs. Kirkbride and Ray, that these cures are not permanent or real, or that the reporters deal in "general assertions and flourishes." As, however, the whole subject has assumed a different phase in the United States, and as an animated controversy is now going on there as to whether habitual drunkenness be a sin or a disease, it becomes expedient to consider whether the existence of such retreats, dignified as hospitals, and administered with all the solicitude and benevolence, and supplied with all the delicacies and luxuries which the sorrowful and suffering require—may not act as premia or encouragements to indulgence; may be resorted to, chiefly to obtain, not reformation, but a clean bill of health and a whitewashed character; and, as workhouses are supposed to perpetuate pauperism, and infirmaries to diminish the carefulness of health

and cleanliness in those classes for whose benefit they are intended, so sanitaria may render respectable that evil which they are created in order to check and to crush. We have often speculated whether, if drunkenness were elected into the place of a virtue and a merit, as it was in chivalric days, when the strength of a man's head, his courage, his noblesse, were measured by the strength and the depth of his potations, what had become obligatory as a duty would not be shunned and violated, as is the case with many other obligations equally agreeable, and enjoining far fewer pains and penalties. In America, the whole matter of intemperance is treated as a national question, and the hopes of its solution are evidently founded upon the corrective influences of inebriate asylums, when the officers of these have been vested with powers of detaining their charges legally, until old habits have been rooted up, new dispositions, purposes, and tastes have been established; until new physical changes have likewise been effected in the constitution; and until reasonable grounds arise for reposing confidence in the self-control of the individual. With the view to consolidate the independent and desultory efforts already made or now in progress, of gathering and diffusing information, and of acting upon the opinion of the public and Legislatures, an association has been formed, somewhat similar to that devoted to social science in Britain, consisting of physicians, philanthropists, and those engaged in the management of charitable or punitive institutions. Of this body, three volumes of annual transactions are now before us. Besides the bare record of formal proceedings, these contain thirty-eight articles of various scope and merit, ranging from "A Brief Paper on the Pathological Influences of Alcohol, and the Nature of Inebriation," over almost every aspect and collateral issue of the subject, to "Practical Points relating to the Criminality, Repression, and Cure of Drunkenness and Dipsomania," which are deserving of serious attention, especially in Britain, where we are at a standstill; where we are not only doing nothing and proposing to do nothing, but where, in some directions, we are positively doing wrong.

The less utopian of our friends in America seem disposed to limit their expectations of triumphing over diseased propensities chiefly to what may be called curable cases, to recent cases, to cases in which there is a sincere desire and effort on the part of the patient to coöperate in the attempts made to effect his restoration. Should any measure be practically adopted in this country for the reclamation of dipsomaniacs, it might be prudent to confine the experiment, in the first instance at least, to these classes; for we cannot but dread the contamination which may arise from constant intercourse of depraved, confirmed, even of unstable drinkers, with those who still retain a recuperative power.

It must be borne in mind, that whatever may be proposed, we have to deal not merely with dram drinkers, but with those who seek excitement or oblivion by ether, eau de cologne, chloral, chlorodyne, chloroform, and opium, and that the effects upon the nervous system of each of these differ somewhat from those of the others. Enormous quantities of the latter drug are imported into this country, much larger, it is believed, than what are required for medicinal purposes, and it is suspected enter into the composition of many of the intoxicating beverages and cordials which are taken in comparative innocence and ignorance of their contents. In America it would appear that opium is largely consumed, and in certain of its forms is exposed for sale as a dram. "I know cases," says Dr. Parrish, "where persons are in the habit of purchasing a milder form of laudanum by the pint or quart, and using it instead of alcoholic liquors" (p. 160, Minutes of Evidence). Nor are we exempt from the responsibility of a similar practice. Dr. Lyon Playfair, in the same page of the same book, "puts the case of three druggists, in one street in Manchester, who weekly supplied six hundred families of the poorer classes with opiates." Opium is said to be a remedy for intemperance, or a means by which abstainers sustain their self-denial, but it may be fairly conjectured that the cure is worse than the disease, involves greater hazards, and demands more stringent arrangements for its prevention and removal.

We were pleasantly surprised, but somewhat startled, by the announcement contained in Miss Emily Faithful's lecture, in our Mechanics' Institute, about two months ago, that, during a sojourn of nearly a year in the United States, she had only seen three drunken persons. Certain dark and discouraging revelations casting a shadow over our memory, we concluded that Miss Faithful must have kept remarkably good company, and must have passed her time in a paradise of undistilled fruits and flowers, and of unfermented golden grain. These revelations are to be found in blue books, but which, from their gloomy contents, should be called black; and in a large collection of reports, essays, etc., upon the subject of intemperance, abstinence, and inebriate asylums, which have been placed in our hands by a friend, a Dumfriesian, now resident in New York. It may be recollected that a Parliamentary committee, appointed under the auspices of the benevolent Mr. Dalrymple, M. P. for Bath, considered the wide subject of habitual drunkards, and their care and reformation, in eighteen hundred and seventy-two. From the inquiries of this body proceeded a vast mass of information, a report, and a bill. The bill proved abortive, its author has since died, and there is at present little prospect that legislation will be revived on the subject.

In the minutes of evidence now referred to, Mr. Dalrymple, who occupied two months in investigating the provisions for the reclamation of the inebriate class in America, states, in reply to the question "Has the greater stringency of the laws in force against intemperance there had the effect of diminishing drunkenness?" "If I may judge from the number of drunkards, I am afraid not." Two distinguished physicians, who have devoted their energies to the care and cure of drunkards and dipsomaniacs in America, were invited to submit their experience upon the bearing and prospects of the whole question to the committee. One of these, Dr. Parrish, physician of the Sanatarium, Media, Philadelphia, deposes that: "I do not know that prohibitory laws have been enforced anywhere. * * * The measures resorted to for evading the law are very curious and very numerous, and it has always been a question with me whether demoralization of society in creating a disrespect for the law, and all sorts of maneuvers to evade it, is not almost as great an evil as the drinking of liquor." And in reply to the question: "Is it your opinion, from the information you have received, that even if the prohibitory law is passed, it is rather hurtful than useful to the cause of temperance?" he said, "I think it is." He likewise quoted a letter from Mr. Otis Clapp, Boston, Assessor of the United States, Fourth District of Massachusetts, and one of the Vice Presidents of the American Association for the Cure of Inebriates, to the effect that "It is no easy matter to state to you the effects of the prohibitory laws and the punishment of drunkards, because the whole question is a sort of muddle.

The prohibitory laws were on the statute books many years, but as it was left to city officials to enforce them, they were not enforced, and we have nothing to settle in the matter of prohibition but what is unsettled, and the consequence is that regular drinkers can purchase what they want. In the rural districts, at a distance from the cities or large towns, it is generally difficult for drinkers to procure intoxicating liquors; but in the cities we have hundreds of poor men and women who keep no bars, but who retail spirits by the glass to customers whom they know, and never have on hand at one time more than one quart or gallon of spirits; they purchase as they need. Indeed, it is peddled from wagons like milk. In short, prohibition may have its advantages, but it is not here more than a partial success." (p. 155)

From the same document we learn that in this country, where no restrictions are in operation or have yet been attempted as to the sale or consumption of stimulants, in eighteen hundred and seventy there were thirty-eight thousand four hundred and forty-one individuals proceeded against by the police as habitual drunkards; that in the same year twenty-one thousand one hundred and thirteen cases of intoxication came under the cognizance of the police in Liverpool; that prisons, reformatories, workhouses, are constantly recruited from the inebriate classes; that fourteen or fifteen per cent of the cases of insanity admitted into public asylums owe their origin directly to intemperance; and that, in the opinion of the eminent psychologists or philanthropists who have contributed information to the committee, the morbid craving for stimulants is the most incurable form of mental disease. There must be added to this sad picture the less precise but equally trustworthy conviction that indulgence, even excessive indulgence, in alcohol, under various forms, is spreading widely and sinking deeply through the social customs of the inhabitants of the Continent; that beer, in larger quantities, is consumed by the Germans; that the juice of the grape has been substituted for the juice of the orange among the Italian peasantry; that the French have jilted their first loved sugar and water for brandy and the more poisonous absinthe; that large numbers of the besieged Parisians, especially their military defenders, were in a state of drunken delirium during the bombardment, and that many of the horrors and absurdities of the Commune could be legitimately traced rather to the abundance of strong drink than to the want of food or the obscuration of reason. We have presented these observations, not with the intention of pointing to a downward course, or of exposing the failure of the religious and moral means at our command in checking inebriety and dissoluteness, but for the purpose of introducing the question, "What has been done, or what is proposed to be done, by men of British origin, to mitigate the consequences of this evil, if all hope of eradicating it must be relinquished?"

We know and appreciate the existence of national confederations, leagues of abstainers, Good Templars, of lecturers and literature, all contending against, and to a certain extent successfully contending against, the ravages of intemperance; but we have never regarded the individuals engaged in this crusade as converts from the befoolment and befuddlement in which our race seems involved, but as sober members of the community, who, either from indifference to excitement or from self-control, have resisted the tendencies and temptations by which they were surrounded, and would have remained abstemious, without the aid of pledges, processions, or the paraphernalia of the middle ages; presenting what may be regarded by some as a prudish, but what is certainly a healthy example, in the midst of a lax or corrupt community. We know that the Church of England has spoken out nobly and loudly in the report of the Lower House of Convocation, as to what may be termed the social and domestic sources of intemperance; that the Church of Rome, by the voice of her highest dignitaries, by sermons, by the formation of societies; and that perhaps all religious bodies have, after their own fashion, contributed to admonish and to warn as to the great and growing evil of our day. Even the doctors, or three hundred of them, have published a sort of penitential confession that unconsciously they may have initiated a love for stimulants, especially among the fairer portion of their patients, by giving tinctures and toddy, or pick-me-ups and champagne, when infusions or "plain cold water" would have answered the purpose. All this, as well as the improved usages of the affluent classes, is in the right direction, but affords no bulwark, no breakwater, against the tide of degradation which seems to be gaining upon us. Moralists, like medical men, are groping blindfolded after the means by which contagion may be prevented, and, in despair of success, are compelled to rest content with the suggestion of remedies, ameliorations, after the disease has been actually established, or during periods of temporary convalescence.

The treatment proposed in this country, as we learn from the minutes of evidence before alluded to, and from other sources, is that, having assumed an individual who has been found intoxicated three times within a given period to be an habitual drunkard, instead of decapitating him, as Charlemagne used to do at this stage, or fining and imprisoning for a brief space, as is the prevalent custom, a magistrate or Sheriff, as the case may be, shall be empowered to consign the offender for long periods, never less than a year, to a reformatory or penitentiary connected with an asylum, a prison, or a workhouse, or existing independently of all these. These depots are to be so situated and constructed that the inmates shall not be brought into contact with lunatics, criminals, or paupers; shall be placed under medical and moral management; shall be taught or employed in various trades and occupations; shall receive for themselves or their families, such proceeds of their labor as shall remain after their maintenance and supervision have been provided for; that they should be regularly visited and examined by public officials, and shall be discharged according to certain forms when they are believed to be recovered—in other words, when they have outlived the effects of former indulgence, the tyranny of former habits and temptations—when not only a new spirit, but a new or repaired physical organization have been created within them, and when they are supposed to be capable of safely and usefully resuming their former position and profession. The weight of authority and experience seems to be in favor of the proposition, that these reformatories should be altogether separated from and independent of other institutions; that for the indigent, they should be erected and maintained partly by local, and partly by national taxes; that for the affluent, their creation should be left to private enterprise; but that, under every circumstance, they should be licensed, regulated, and inspected, according to a special Act. It is almost needless to remark that this project is an outcome of the pernicious practice of placing drunkards in asylums, in those improvised, unrecognized, and we suspect very inefficient retreats scattered over the country, in islands, remote corners, and secluded spots, and superintended by self-constituted guardians of every grade, from the priest and physician, to the butcher and the bricklayer; or, in that extraordinary hospital of

all the moral ills and infirmities which flesh is heir to, Queensberry House. A curative home is the central idea of all the recommendations before us, but from this there radiate innumerable plans which may be regarded either as natural sequences or absurd excrescences. It has been mooted that the Danish mode of treating military drunkards, or the surfeiting the culprit with whisky while in prison, the deprivation of all other nourishment, society, occupation, etc., should be incorporated with, or should precede moral training. It has been gravely argued that the reformatory should be a village, that honor, truthfulness, and confidence in which inebriates are notoriously deficient, should take the place of bolts, bars, restraint, and captivity, and that, for stern warders or attendants, should be substituted enlightened companions and moral guides. Another cure is to be sought for in the spread of education, especially an instruction in physiology and in pointing out to the toper and tippler, not simply that he is doing wrong, but that he is burning up his vitals by a slow but sure process of spontaneous combustion. When all this chaff has been blown away by the wind of public discussion, there remained but two sound grains which promised to germinate and give some return—prolonged abstinence and detention. America, either borrowing from the example of our private speculations, or pressed by its own necessities, by inoperative and evaded permissive and optional bills, and by the prevalence of drunkenness, has anticipated the course suggested by the report, and has already instituted several homes or hospitals for inebriates, and encouraged by the supposed success of this arrangement, is clamorous for its extension.

CLIMATOLOGY AND CONSUMPTION.

By THOMAS M. LOGAN, M. D.

It has been claimed that the extension of civilization, the pursuit of agriculture, the drainage and reclamation of vast tracts of marshes, and particularly the felling of forests, have made great changes in the climate of the United States, especially in respect to temperature and rainfall. But whatever of truth there may be in the theories of man's agency in modifying climate, we cannot go beyond the results of the records, which have been made through a long series of years. Unsatisfactory as these records may be, they nevertheless constitute the only reliable data that we have for determining, whether either of the climatic conditions just referred to are increasing or diminishing—stationary or periodic.

From an examination of the results of all the observations which have been collected by Professor Henry and published in the reports of the Smithsonian Institution, we find that there has been no material change in the average rainfall, when long periods of time are compared, however the annual amount may vary. The irregularities in the successive yearly precipitation, though found to be very great in the different groups of the stations where the observations were made, and into which they were classed for the purpose of being systematically studied, nevertheless do not obliterate the appearance of conformity to general laws. The only decided indications of any material change are found in groups one and two, comprising New England and the Middle States, where the rainfall seems to have steadily increased since the year eighteen hundred and eighteen, in the very district which has been most stripped of its clothing of forest. Thus the power of augmenting the fall of rain which has been largely attributed to trees, vaguely by some, who confound such an attribute with their power of attracting mists, and boldly by others, who assert that rain now falls where trees have been planted in tracts formerly rainless, cannot longer be logically entertained. We learn positively from the mean results, as tabulated, that the rainfall during one hundred and thirty-seven years has undergone no change on this continent. The humidity of the great aerial currents is quite independent of local causes. The winds, charged with moisture collected in other regions, discharge their rain with indifference over wooded and unwooded districts, and the rainfall is not now more or less than it ever was.

The same conclusions may be drawn from the results of the temperature records, the fluctuations of which are found to be quite uniform throughout the entire country. Two or three years near eighteen hundred and twelve are historically known as cold years; and a reference to this period shows them to have been more extreme than any since, if we

except the present Winter of eighteen hundred and seventy-four–seventy-five, in the Eastern States. Next in severity come the cold years eighteen hundred and thirty-five–thirty-six, and eighteen hundred and thirty-six–thirty-seven. The next coldest groups were eighteen hundred and twenty-three–twenty-four, eighteen hundred and forty-three–forty-four, and eighteen hundred and seventy-four–seventy-five. The high temperature groups are eighteen hundred and twenty-five–thirty, eighteen hundred and forty-four–forty-eight, and eighteen hundred and fifty-three.

It would seem that there are two classes of non-periodic changes—one less frequent and affecting longer periods, and another causing changes above or below the general line of these long periods, and belonging to periods of a year or two. Further than this we find no results worthy of special mention from these long continuous observations over our vast territory, and hence infer that man's agency in influencing either the temperature or aqueous precipitation is, as far as we are able to judge, altogether insignificant. Similar inferences are deducible from the results of the observations made on the Pacific slope. In the comparatively brief records herewith presented, there is no evidence discernible of progressive or retrogressive movements, either in the temperature or in the rainfall. But the question of the rainfall, or of the temperature, does not settle the question of humidity. The humidity of the atmosphere depends not so much upon the amount of precipitation in rain as upon the rapidity of the process of evaporation and drainage; and it is here that man's agency proves instrumental in modifying climate. Our country, which was once largely covered with an unbroken forest, is now, to a great extent, denuded; the decrease of the forests being at the ratio of seven millions of acres annually. The rain, which was gradually conveyed by the leaves of trees to a dense undergrowth and layer of fallen leaves and vegetable mould, which absorbed it like a sponge, and whence it was transferred by the roots to the depths of the soil, now runs off by the nearest watercourses, leaving no supply of water during dry weather. (1) The restraint of evaporation by the dense shield afforded by forest shade being thus removed, the sun pours down upon the unprotected soil and rapidly evaporates the superficial water. The natural consequence of all this is an increased dryness of the atmosphere. This conclusion, which is arrived at from

(1) It appears from statistics published in the report of the Agricultural Department in eighteen hundred and seventy-two, that California has a less area of forest in proportion to her farm lands than any other State in the Union. The whole area of the State is estimated at one hundred and twenty millions nine hundred and forty-seven thousand eight hundred and forty acres, of which one hundred and nine millions five hundred and twenty thousand seven hundred and fifty-five acres are not cultivated. The estimated area in woodland is nine millions six hundred and four thousand six hundred and seven acres, of which that which is included in farms is only four hundred and seventy-seven thousand eight hundred and eighty acres. The area in farms is estimated at eleven millions four hundred and twenty-seven thousand one hundred and five acres, of which only about 4.1 per cent is in woodland. Nevada has 6.4 per cent; Nebraska, 10.2; Kansas, 11.2; Iowa, 16.2; Illinois, 19.6. The proportion increases from the Pacific Coast towards the East to Indiana, which has 39.6 per cent, and then there is a gradual decrease to the Atlantic. The Southern States have a much larger proportion of forests. The proportion of forest to farm area in West Virginia is 51.1; Arkansas, 51.4; South Carolina, 53.4; Georgia, 54.6; Tennessee, 55; Alabama, 56; Florida, 60; North Carolina and Mississippi each 60.6 per cent. In the Territories the percentage—with one exception, that of Washington, which has 44.8 per cent—is quite small, being in Utah one tenth of one per cent; Montana and Wyoming 8.10 of one per cent; Colorado, 3.5; Dakota, 7.4; Idaho, 9.6, and New Mexico, 12.7. The scarcity of timber upon our farm lands adds largely to the strength of climatic reasons for an extended culture of forest trees.

general observation and practical knowledge, needs not the proofs that physical science affords by means of the wet and dry bulb thermometers. The facts are patent and intelligible to all, and can be measured in an uncovered district by the sensible diminution of a mountain stream after a day of intense sunshine. In California, on the eastern side of our great valley, in places where the upper lands have been cleared of trees, the rainwater descends impetuously in a torrent, leaving tiny streams, which flow steadily for many days, so long as the sky remains overcast, but cease altogether after a single day of sunshine.

In this connection, I would add that the rains are not now either lighter or heavier, or more fitful, than in former times, but there are fewer woods to restrain the drops, which unite to denude the rocks of their soil, and to form the mighty torrents, conveying thousands of tons of detritus to fill up the rivers, as witnessed every Winter season. It cannot be doubted but that an extensive planting of trees in the valleys, at the head of the main ravines, where cachement areas of twenty-two thousand seven hundred and forty-two square miles (1) have been hypothetically plotted out, as seen in the accompanying map in this report, according to the projected irrigation plans of the United States Commission, would superinduce a more humid condition of the atmosphere, and lead to a more constant supply of water, in a region now arid and desolate, for more than six months in the year. The evaporation from such immense reservoirs as are contemplated by these surveys, would be simply enormous, and, if intercepted by the trees before being com-

(1) From report of the Board of Commissioners on the irrigation of the San Joaquin, Tulare, and Sacramento Valleys of California, eighteen hundred and seventy-four.

TABLE showing area in square miles of cachement basins.

Name of river or creek.	Cachement area.
Feather River	3,394
Kern River	2,382
American River	1,889
King River	1,853
San Joaquin River	1.631
Tuolumne River	1,514
Yuba River	1,329
Merced River	1,073
Cache Creek	1,025
Stanislaus River	971
Stony Creek	591
Cosumnes River	590
Putah Creek	584
Mokelumne River	573
Walker's Basin Creek	461
Calaveras River	390
Arroyo Los Gatos	343
Big Panoche Creek	319
Chowchilla River	304
Bear River	300
Posa Creek	278
Fresno River	258
Cantua Creek	164
Little Panoche Creek	136
Arroyo de Los Baños	125
Orestimba Creek	125
San Luis Creek	81
Arroyo del Puerto	79
Total	22,742

TABLE showing area in square miles in each county, and area of valley compared with area of mountains.

Name of county	Area of valley.	Area of mountains.	Total.
Alameda	6	74	80
Alpine		508	508
Amador		576	576
Butte	502	1,060	1,562
Calaveras		1,037	1,037
Contra Costa	159	177	336
Colusa	1,117	1,503	2,620
El Dorado		1,243	1,243
Fresno	3,270	5,560	8,831
Kern	2,798	2,642	5,440
Lake		1,121	1,121
Mariposa		1,418	1,418
Merced	1,312	607	1,919
Napa		318	318
Nevada		806	806
Placer	112	1,027	1,139
Plumas		2,638	2,638
Sacramento	929	73	1,002
San Joaquin	1,271	121	1,392
Shasta	30	770	800
Sutter	530	74	604
Sierra		723	723
Solano	600	186	706
Stanislaus	1,015	504	1,519
Tehama	880	2,053	2,932
Tulare	2,476	3,270	5,746
Tuolumne		1,942	1,942
Yolo	653	403	1,056
Yuba	162	482	644
	17,822	32,916	50,658

pletely vaporized, the minute component vesicles of water would coalesce upon the leaves and branches, and fall in drops upon the earth.

This I regard as the principal mode by which trees may have a tendency to increase the general humidity of the climate; but, from sanitary considerations, this would be undesirable anywhere, except in the arid and semi-tropical zone of California. In no other respects, perhaps, has the influence of the superinduced dryness of the climate of the Eastern States, already alluded to, been more palpably demonstrated than in its results upon certain diseases; and no stronger evidence can be adduced in support of this conclusion than that afforded in an abstract, compiled from two tables, by Dr. Ham, of Dover, New Hampshire, to whose valuable paper, bearing on the whole subject under discussion, I am largely indebted.

From the first table, exhibiting the amount and ratio of sickness and mortality in the United States army from phthisis pulmonalis, during fifteen years, commencing in eighteen hundred and forty and ending in eighteen hundred and fifty-four, it is shown that temperature, considered by itself, does not have that controlling influence upon phthisis which has been attributed to it, but that *dryness* is the most important atmospheric condition.

The lowest ratio of cases of consumption occurs in New Mexico; there $1\frac{3}{10}$ per cent per one thousand soldiers; and the highest in the South Atlantic region, where it is $9\frac{2}{10}$ per cent per one thousand. The Gulf coast of Florida gives the next highest proportions, being $7\frac{2}{10}$ per one thousand of mean strength. New England has $4\frac{8}{10}$ per one thousand mean strength.

The second table referred to, constructed from the vital statistics of Boston, New York, and Philadelphia, and within the region of the modification of climate in respect to humidity, shows a relative decrease in the number of deaths from phthisis pulmonalis since eighteen hundred and ten.

IN BOSTON.

From 1810 to 1820	1 death from phthisis in 4 6-10 deaths.
From 1820 to 1830	1 death from phthisis in 6 deaths.
From 1830 to 1840	1 death from phthisis in 7 1-2 deaths.
From 1840 to 1850	1 death from phthisis in 7 deaths.

IN NEW YORK CITY.

From 1810 to 1820	1 death from phthisis in 4 1-2 deaths.
From 1820 to 1830	1 death from phthisis in 5 3-5 deaths.
From 1830 to 1840	1 death from phthisis in 5 9-10 deaths.
From 1840 to 1850	1 death from phthisis in 7 7-10 deaths.
From 1850 to 1855	1 death from phthisis in 8 7-10 deaths.

IN PHILADELPHIA.

From 1810 to 1820	1 death from phthisis in 6 4-10 deaths.
From 1820 to 1830	1 death from phthisis in 6 7-10 deaths.
From 1830 to 1840	1 death from phthisis in 7 4-10 deaths.
From 1840 to 1850	1 death from phthisis in 7 2-10 deaths.
From 1850 to 1855	1 death from phthisis in 8 2-10 deaths.

The same authority thinks that this falling off in the relative number of deaths from phthisis, during the last seventy years, obtains, also, in all the diseases of the respiratory system, and is largely due to the comparative absence of ozone, which exists in large proportion in a humid atmosphere.

Dr. Pfaff gives (1) an account of his observations at Plauer, in Saxony, at one thousand and fifty German feet above the level of the sea. He has not found the direction of the wind influencing the presence of ozone. He has found stormy weather exceedingly favorable to its production; the ozone appearing immediately in large quantity during a storm suddenly coming on, after a succession of fine weather unaccompanied by ozone. Test paper, which had long remained unchanged, would then denote eight degrees of ozone; while as soon as the storm had passed away all reaction on the test paper would cease—the storm seeming to bring and take away with it the ozone. Similar but less rapid increase in the ozone was observed during mere changes of weather, as when fine weather of long duration was followed by rain. As a general rule moisture was favorable to the development of ozone. Little or no influence was exerted by temperature; the proportion of ozone not being greater in Winter than in Summer.

The following are Dr. Pfaff's conclusions with respect to the influence of ozone:

1. A large proportion of ozone in the atmosphere acts mischievously on diseases of the respiratory organs.
2. The ozone of the air exerts little or no influence on epidemic diseases, provided that these are not complicated with catarrhal affections.
3. A large amount of ozone in the air, whatever may be the direction of the wind, favors the development of inflammatory affections, and especially of tonsilitis.
4. Other diseases besides those mentioned do not seem to be influenced by the amount of ozone.

In the presence of such facts and deductions, the planting of trees in California may appear inconsistent. It must be remembered, however, that the extreme aridity of the climate is very peculiar—in fact, it is too dry; and it need only be remarked here, that this extreme does not belong to the Summer season alone. The mean relative humidity of the five rainy months (October to March) in Sacramento is 72°, and at no time ever reached complete saturation. During the dry season the moisture generally amounts to less than fifty per cent; the temperature of evaporation during the hottest part of the day not unfrequently reaching 25° to 30°. Taking the mean of the whole year, this percentage is 66°. Now, as the most agreeable and salutary amount of humidity (2) is between seventy and eighty per cent, such a great deviation from this healthy standard as is here met with, cannot but be fraught with more or less danger to the imprudent. The equability of any climate is largely dependent upon the presence of aqueous vapor. The most potent of the sun's heating rays are largely intercepted in an atmosphere which is, to any extent, charged with watery vapor; and hence it is that the entire solar force is unfelt in our coast region, where the evaporation from the sea perpetually supplies an effectual screen. The intensity of the sun's direct rays, as measured by a blackened-bulb thermometer, *in vacuo*, fluctuates from 120° to 135°. The variations appear to coincide distinctly with the amount of atmospheric humidity, the thermometer rising to 148° in our great valley

(1) Vol. 46 of Braithwaite's Retrospect.

(2) Parks' Practical Hygiene.

during the arid northwest winds, and seldom attaining more than 125° during our humid southeast winds. The dangerous difference between sunshine and shade is, therefore, due to the absence of aqueous vapor. There is no cold shade in an atmosphere reasonably humid, inasmuch as the contained aqueous vapor intercepts and diffuses the excess of solar heat, and renders the shade safe and temperate. But, when the air is too dry to intercept any great quantity of solar heat, the direct rays of the sun become oppressively hot, whilst the shade is dangerously cold.

The vapor of water has also another use. When the atmosphere is dry and the sun is gone, the earth rapidly loses heat by radiation into space. A moist atmosphere, on the contrary, is to a certain extent impervious to the passage of the rays of heat, and a moderate temperature is maintained throughout the night. In the Summer climate of the interior valleys of California this shield of vapor is absent, and hence we experience great extremes of night and day, and of Summer and Winter. While referring to the accompanying tables to sustain what is advanced, we would here remind the general reader of the nature and value of mean temperatures. It must be understood that they are merely averages founded upon columns and pages of individual observations. Mean temperatures merely give the *amount* of heat observed in given periods, without mention of the manner in which it is distributed, and the consequent variations to which a climate may be subject. A moderate mean annual temperature may, for instance, represent a climate like that of Santa Barbara, wherein night and day, Winter and Summer, closely approximate in the quantity of apportioned heat; and also a climate such as that of Nice and Mentone, in France, regularly or irregularly subject to heat too intense in Summer to be encountered by invalids, and also too frosty cold in Winter. Nothing is more common than for those who consult meteorology to seize upon the annual mean temperature as a solitary point of comparison whereupon to ground their judgment, not discerning that therein the excess of Summer heat is made to compensate for deficient Winter warmth.

Now the great reduction, by rapid radiation of heat after the maximum is reached, is the most striking as well as the most important feature, from a sanitary point of view, of the interior climate of California. The extreme monthly ranges prove that the greatest transitions occur from May to October, inclusive, which is the rainless period. The mean maximum for these six months is 89.73°, and the mean minimum 40.63°. Consequently, the mean extreme Summer range is 49.10°. But this does not exhibit the extreme monthly ranges, which sometimes reach beyond 50° during our arid north winds, when the thermometrograph leaves its mark in the neighborhood of 100°. However high the wave of temperature may tower up, under the influence of a vertical sun and almost vaporless atmosphere, it sinks proportionately low at night, rendering it, by contrast, so cold and chilling that blankets become indispensable for comfort. This Asiatic feature of the climate, while it imparts a resiliency or elasticity to animal life, is at the same time treacherous to the health, especially of the feeble and delicate, and often acts as an exciting cause of disease. We thus are enabled to understand why an attack of intermittent is sometimes brought about by the removal of an inhabitant of the interior valleys to San Francisco, or to a cool mountain region. In fact, every sort of cooling down, dry as well as moist, especially if the body has been particularly heated, may give rise to the development of malarial affections.

Paradoxical as it may seem, after what has been advanced in the preceding pages of this report respecting the well-recognized agency of humidity as one of the factors of malaria, to recommend measures calculated to promote this very humidity, still it must be remembered that excesses of heat and aridity are the great exigencies in our present sanitary forecastings. Do what we will and all we can, our labors would prove but pigmy efforts towards transforming those grand climatic features which are due to influences far beyond our control. To provide against extremes, and to temper the burning aridity of our treeless plains, which, during a northwest wind in Summer, compares almost at times with that of the Desert of Sahara, is a very different thing from attempting to induce that excess of moisture due to cosmic causes, and which sometimes imparts to the climate of our Atlantic cities the deadly characteristics of the Terras Calientes of the Mexican coast. All we can hope to effect is to equalize, to a certain extent, the temperature in sunshine and shade, and, through the instrumentality of arboriculture, to retard, if not prevent, the action of the sun in quickening into activity noxious fermentation. It has been my purpose to show that our climate possesses inherent capacity for sanitary modifications; and knowing that it may be ultratropical at times, during our dry Summer, it is incumbent on me to prepare for all the contingencies of such a condition, by suggesting every possible safeguard against the dangers to which the people may be subjected at such periods.

The following tables, of the results of meteorological observations for a series of years at Sacramento and San Francisco, being representative types of the interior valley and coast climates of California, are worthy of close study and attention:

TABLE NO. 1 OF RAINY DAYS AND RAIN IN SACRAMENTO.

Arranged according to the seasons, showing the amount of rain, in inches, of each month during twenty-five years, and for each rainy season; also, the number of rainy and foggy days during which the amount of rain fell in each month in the same period.

Months.	1849. Quantity	1849. Days	1850. Quantity	1850. Days	1851. Quantity	1851. Days	1852. Quantity	1852. Days	1853. Quantity	1853. Days	1854. Quantity	1854. Days	1855. Quantity	1855. Days	1856. Quantity	1856. Days	1857. Quantity	1857. Days
September	0.250	......	0.000	......	1.000	1	0.003	......	0.000	1	sprinkle.	1	sprinkle.	......	sprinkle.	1	0.000	......
October	1.500	3	0.000	......	0.180	2	0.000	1	0.005	1	1.010	11	0.000	......	0.195	6	0.655	3
November	2,250	8	sprinkle.	1	2.140	5	6.000	12	1.500	5	0.650	2	0.750	9	0.651	10	2.406	10
December	12.500	12	sprinkle.	2	7.070	14	13.410	20	1.540	4	1.150	8	2.000	13	2.396	13	6.632	13
	1850.		1851.		1852.		1853.		1854.		1855.		1856.		1857.		1858.	
January	4.500	15	0.650	5	0.580	4	3.000	12	3.250	6	2.670	15	4.919	16	1.375	14	2.444	21
February	0.500	5	0.350	4	0.120	4	2.000	6	8.500	14	3.460	7	0.692	6	4.801	17	2.461	13
March	10.000	7	1.880	7	6.400	14	7.000	8	3.250	4	4.200	9	1.403	5	0.675	10	2.878	13
April	4.250	3	1.140	3	0.190	3	3.500	7	1.500	9	4.320	9	2.132	8	sprinkle.	1	1.214	3
May	0.250	......	0.690	2	0.300	1	1.450	4	0.210	4	1.150	6	1.841	4	sprinkle.	3	0.203	4
June	0.000	......	0.000	......	0.000	......	0.001	1	0.310	2	0.010	1	0.033	1	0.350	2	0.098	2
July	0.000	......	0.000	......	0.000	......	0.001	2	0.000	......	0.000	......	0.000	......	0.012	1	0.000	......
August	0.000	......	0.000	......	0.000	......	0.000	......	sprinkle.	1	0.000	......	0.000	......	sprinkle.	1	sprinkle.	4
Totals	36.000	53	4.710	24	17.980	48	36.365	73	20.065	51	18.620	69	13.770	62	10.455	79	18.991	86

RAIN TABLE NO. 1—Continued.

Months.	1858. Quantity	1858. Days	1859. Quantity	1859. Days	1860. Quantity	1860. Days	1861. Quantity	1861. Days	1862. Quantity	1862. Days	1863. Quantity	1863. Days	1864. Quantity	1864. Days	1865. Quantity	1865. Days
September	sprinkle.	5	0.025	3	0.063	2	0.000	......	0.000	......	0.003	1	0.004	1	0.080	4
October	3.010	5	0.000	......	0.914	9	sprinkle.	1	0.355	6	0.000	......	0.120	2	0.480	5
November	0.147	11	6.485	15	0.181	5	2.170	12	0.005	2	1.490	7	6.718	9	2.427	9
December	4.329	17	1.834	17	4.282	20	8.637	22	2.327	11	1.815	10	7.867	16	0.364	9
	1859.		1860.		1861.		1862.		1863.		1864.		1865.		1866.	
January	0.964	19	2.310	15	2.668	10	15.036	20	1.733	10	1.077	7	4.776	13	7.699	18
February	3.906	18	0.931	14	2.920	9	4.260	11	2.751	11	0.186	2	0.712	6	2.010	11
March	1.637	14	5.110	17	3.320	7	2.800	15	2.360	10	1.303	12	0.481	7	2.018	11
April	0.981	6	2.874	8	0.475	4	0.821	9	1.693	9	1.080	4	1.370	3	0.476	6
May	0.981	4	2.491	10	0.590	3	1.808	9	0.355	2	0.742	8	0.460	2	2.252	5
June	1.037	......	0.017	2	0.135	4	0.011	......	0.000	......	0.087	3	0.000	......	0.100	2
July	0.000	1	0.549	3	0.000	......	0.000	1	0.000	1	0.000	......	0.004	3	0.018	3
August	0.030	......	0.000	......	0.000	......	0.006	......	0.000	2	0.085	3	0.000	......	0.000	......
Totals	16.041	100	22.626	104	15.548	73	35.549	100	11.579	64	7.868	52	22.512	62	17.924	83

Rain Table No. 1—Continued.

Months.	1866. Quantity	1866. Days	1867. Quantity	1867. Days	1868. Quantity	1868. Days	1869. Quantity	1869. Days	1870. Quantity	1870. Days	1871. Quantity	1871. Days	1872. Quantity	1872. Days	1873. Quantity	1873. Days	1874. Quantity	1874. Days
September	0.000	1	0.006	1	0.000	......	sprinkle.	1	0.000	......	0.001	1	0.002	2	0.000	......	0.050	1
October	0.001	1	0.000	1	0.000	3	2.120	2	0.020	2	0.210	1	0.220	2	0.310	4	2.257	8
November	2.426	8	3.806	6	0.774	5	0.850	5	0.584	6	1.220	8	1.930	4	1.210	5	3.801	9
December	9.511	21	12.850	18	2.612	11	1.962	7	0.971	6	10.590	22	5.388	13	10.009	21	0.440	17
	1867.		1868.		1869.		1870.		1871.		1872.		1873.		1874.		1875.	
January	3.440	15	6.036	17	4.790	14	1.371	9	2.075	8	4.040	11	1.230	10	5.200	14	8.705	14
February	7.104	9	3.147	9	3.630	5	3.236	11	1.919	11	4.740	18	4.360	17	1.856	9	......	......
March	1.010	6	4.348	12	2.942	12	1.642	6	0.690	8	1.936	10	0.551	4	3.050	10	......	......
April	1.805	7	2.306	9	1.240	5	2.120	7	1.454	6	0.610	6	0.512	4	0.890	10	......	......
May	0.008	1	0.270	2	0.648	2	0.270	1	0.756	5	0.280	3	0.000	......	0.370	6	......	......
June	0.000	1	sprinkle.	3	0.008	1	sprinkle.	1	0.001	1	0.025	1	0.002	1	0.002	2	......	......
July	0.000	1	0.000	......	0.000	......	sprinkle.	1	0.000	......	0.000	......	0.015	2	0.001	1	......	......
August	0.000	1	0.000	......	0.000	......	0.001	1	0.000	......	0.000	2	sprinkle.	1	0.000	......	......	......
Totals	25.305	72	32.769	78	16.644	58	13.572	57	8.470	53	24.052	83	14.208	60	21.898	82	......	......

RAIN TABLE NO. 2, FOR SAN FRANCISCO.

Prepared by THOMAS TENNENT.

Months.	1849. Quantity	1849. Days	1850. Quantity	1850. Days	1851. Quantity	1851. Days	1852. Quantity	1852. Days	1853. Quantity	1853. Days	1854. Quantity	1854. Days	1855. Quantity	1855. Days	1856. Quantity	1856. Days	1857. Quantity	1857. Days
July	......	......	......	......	......	......	......	......	......	......	......	......	......	......	.02	1	......	......
August	......	......	......	......	......	......	......	......	.04	1	.01	1	......	......	......	......	.05	2
September	......	......	0.33	4	1.03	1	......	......	.46	4	.15	3	......	......	.07	2	......	......
October	3.14	3	......	......	.21	2	.80	1	.12	2	2.41	9	......	......	.45	5	.93	3
November	8.66	8	0.92	7	2.12	5	5.31	12	2.28	12	.34	2	.67	7	2.79	9	3.01	11
December	6.20	12	1.05	4	7.10	14	13.20	20	2.32	11	.81	3	5.76	15	3.75	12	4.14	8
	1850.		1851.		1852.		1853.		1854.		1855.		1856.		1857.		1858.	
January	8.34	15	0.72	5	.58	4	3.92	11	3.88	10	3.67	11	9.40	13	2.45	7	4.36	8
February	1.77	5	0.54	4	.14	4	1.42	5	8.04	16	4.77	10	.50	4	8.59	15	1.83	8
March	4.53	7	1.94	9	6.68	14	4.86	6	3.51	11	4.64	12	1.60	5	1.62	6	5.55	8
April	0.46	3	1.23	8	.26	3	5.37	8	3.12	9	5.00	10	2.94	6	......	......	1.55	4
May	......	......	0.67	3	.32	1	.38	7	.02	1	1.88	6	.76	3	.02	3	.34	3
June	......	......	......	......	......	......	......	......	.08	2	......	......	.03	1	.12	1	.05	1
Totals	33.10	53	7.40	44	18.44	48	35.26	70	23.87	79	23.68	67	21.66	54	19.81	61	21.88	56

RAIN TABLE FOR SAN FRANCISCO—Continued.

MONTHS.	1858. Quantity	1858. Days	1859. Quantity	1859. Days	1860. Quantity	1860. Days	1861. Quantity	1861. Days	1862. Quantity	1862. Days	1863. Quantity	1863. Days	1864. Quantity	1864. Days	1865. Quantity	1865. Days	1866. Quantity	1866. Days
July	.05	2	......	......	.21	1	......	......	......	......	......	......	......	......	......	......	......	......
August	.16	2	.02	1	......	......	......	......	......	......	......	......	.21	3	......	......	......	......
September	......	......	.03	1	......	......	.02	1	......	......	.03	1	.01	1	.24	2	.11	2
October	2.74	4	.05	1	.91	12	......	......	.40	2	......	......	.13	3	.26	4	......	......
November	.69	5	7.28	15	.58	3	4.10	12	.15	3	2.55	5	6.68	8	4.19	10	3.35	12
December	6.14	14	1.57	6	6.16	21	9.54	16	1.80	8	1.80	8	8.91	18	.58	8	15.16	18
	1859.		1860.		1861.		1862.		1863.		1864.		1865.		1866.		1867.	
January	1.28	4	1.64	8	2.47	8	24.26	18	3.63	9	1.83	5	5.14	9	10.88	16	5.16	15
February	6.32	18	1.60	7	3.72	8	7.53	10	3.19	10	......	......	1.34	8	2.12	9	7.20	9
March	3.02	11	3.99	13	4.08	8	2.20	11	2.06	8	1.52	9	.74	4	3.04	12	1.58	7
April	.27	4	3.14	8	.51	4	.73	9	1.61	9	1.57	4	.94	3	.12	1	2.36	8
May	1.55	4	2.86	11	1.00	3	.74	5	.23	2	.78	5	.63	2	1.46	6	......	......
June	......	......	.09	2	.08	2	.05	1	......	......	......	......	......	......	.04	1	......	......
Totals	22.22	68	22.27	73	19.72	70	49.27	83	13.62	52	10.08	37	24.73	59	22.93	69	34.92	71

RAIN TABLE FOR SAN FRANCISCO—Continued.

MONTHS.	1867. Quantity	1867. Days	1868. Quantity	1868. Days	1869. Quantity	1869. Days	1870. Quantity	1870. Days	1871. Quantity	1871. Days	1872. Quantity	1872. Days	1873. Quantity	1873. Days	1874. Quantity	1874. Days
July	......	......	......	......	......	......	......	......	......	......	......	......	.03	2	......	......
August	......	......	......	......	......	......	......	......	......	......	......	......	.15	3	......	......
September	.04	1	......	......	.12	1	.03	1	.03	2	.14	1	......	......	.08	2
October	.20	1	.15	3	1.29	2	......	......	.11	2	.21	1	.68	2	2.73	8
November	3.41	6	1.18	5	1.19	5	.43	4	3.72	9	2.62	3	1.31	6	5.92	7
December	10.69	18	4.34	11	4.31	7	3.38	8	16.74	14	7.25	10	10.12	20	.28	4
	1868.		1869.		1870.		1871.		1872.		1873.		1874.		1875.	
January	9.50	17	6.35	14	3.89	9	3.07	7	4.22	10	2.17	8	4.85	14	6.97	12
February	6.13	9	3.90	5	4.78	9	3.86	10	6.97	20	4.24	17	1.83	10	.20	*1
March	6.30	12	3.14	12	2.00	8	1.29	8	1.64	10	.78	4	3.55	15	......	......
April	2.31	9	2.19	5	1.53	4	1.93	5	1.10	7	.52	3	.04	7	......	......
May	.03	2	.08	2	.20	2	.21	3	.16	3	.01	1	.34	4	......	......
June	.23	3	.02	1	......	......	......	......	.02	2	.08	1	.08	2	......	......
Totals	38.84	78	21.35	58	19.31	47	14.10	46	34.71	79	18.02	49	23.98	85	16.18	*34

* Up to ninth of February.

TABLE No. III.

Mean temperature of each month at Sacramento, since eighteen hundred and fifty-two, deduced from three daily observations; also, the mean temperature of each year, and the average of twenty-two years.

Months.	1853.	1854.	1855.	1856.	1857.	1858.	1859.	1860.	1861.	1862.	1863.	1864.
January	43.00	43.00	43.71	48.02	48.54	45.03	44.87	46.20	47.12	46.41	46.87	49.17
February	50.00	51.00	52.50	52.64	50.25	52.24	50.49	49.83	52.17	47.50	47.96	53.65
March	59.80	53.00	54.82	57.03	56.42	53.74	51.47	53.30	55.05	53.58	57.62	56.07
April	61.00	60.00	58.06	58.80	63.27	59.80	57.11	57.82	60.65	58.05	59.46	62.12
May	68.00	62.00	60.20	63.91	65.51	65.19	63.03	58.48	63.70	61.25	67.14	68.48
June	77.00	67.00	71.10	71.06	71.93	69.43	74.85	65.64	66.18	69.33	69.08	71.10
July	75.00	80.63	72.55	75.12	71.45	70.81	69.07	73.17	73.57	73.19	75.63	74.84
August	71.00	69.47	73.04	69.59	71.31	70.57	67.16	73.50	69.73	75.00	70.66	74.70
September	76.00	65.05	68.01	70.93	67.93	68.90	65.89	67.59	67.78	70.41	68.98	69.83
October	78.00	60.01	63.01	58.04	61.49	59.51	63.28	59.76	59.91	67.60	62.84	64.54
November	53.00	55.05	50.65	52.18	53.24	54.23	54.05	53.47	53.60	53.15	52.74	53.53
December	48.00	47.93	45.99	43.86	47.37	44.47	43.52	49.34	50.93	46.44	46.49	50.18
Mean	62.57	59.51	59.47	60.10	60.73	59.49	58.73	59.01	60.12	60.16	60.35	62.82

Table No. III—Continued.

Months.	1865.	1866.	1867.	1868.	1869.	1870.	1871.	1872.	1873.	1874.	Average, 22 years..
January	47.42	46.52	48.18	47.00	47.65	48.61	48.33	48.48	52.70	45.70	46.47
February	49.04	53.48	47.80	50.50	49.90	51.10	49.40	53.27	48.21	49.30	50.55
March	53.60	54.18	50.67	55.00	53.63	53.05	56.00	56.77	56.84	52.90	54.41
April	59.35	61.89	59.70	60.10	59.00	57.00	59.25	57.60	60.00	59.50	59.52
May	70.22	63.06	64.39	64.25	64.20	61.02	61.50	67.00	67.87	64.70	64.31
June	73.47	72.16	70.30	69.50	70.82	69.33	70.10	69.20	71.73	70.20	70.46
July	74.01	76.23	73.75	73.80	74.41	71.76	70.20	71.42	73.19	72.80	73.48
August	71.74	76.03	71.74	71.20	71.26	72.57	72.00	73.13	66.30	70.90	71.48
September	68.84	72.16	68.84	68.30	69.90	68.00	67.43	68.83	69.90	70.70	69.10
October	63.07	65.20	62.72	61.96	63.11	63.61	62.20	58.90	61.40	61.70	62.58
November	56.90	53.84	54.80	53.90	54.00	53.37	50.23	51.16	57.50	53.93	53.56
December	44.13	50.17	46.82	47.00	46.52	45.51	48.67	48.97	47.70	45.00	47.05
Mean	60.98	62.08	59.90	60.11	60.36	59.58	59.60	60.43	60.66	59.78	60.25

TABLE No. IV.

Showing the mean relative humidity for thirteen years, at Sacramento; saturation being one hundred.

Month.	Amount.
January	78.82 per cent.
February	74.08 per cent.
March	78.38 per cent.
April	66.09 per cent.
May	63.29 per cent.
June	58.48 per cent.
July	56.14 per cent.
August	57.66 per cent.
September	58.83 per cent.
October	61.88 per cent.
November	69.65 per cent.
December	76.60 per cent.
Mean for thirteen years	66.67 per cent.

TABLE No. V.

Showing the mean of all the highest readings by day, and all the lowest readings by night, as noted by the thermometrograph, during ten years, at Sacramento.

Month.	Mean of all highest readings by day.	Mean of all lowest readings by night.	Mean daily range during ten years.
	°	°	°
January	60.19	31.00	29.19
February	64.69	34.30	30.39
March	70.09	37.70	32.39
April	79.90	43.20	36.70
May	83.70	46.80	36.90
June	93.30	52.20	41.30
July	95.00	55.20	39.80
August	93.20	45.20	48.00
September	89.90	52.11	37.79
October	83.30	43.30	40.00
November	70.50	36.70	33.80
December	60.70	34.90	25.80
Annual average	78.70	42.68	36.02

TABLE No. VI.

Showing the mean temperature of each month, for twenty-four years, in San Francisco (Dr. Gibbons), and of each month in twenty-two years, in Sacramento (Dr. Logan).

Month.	Twenty-four years, San Francisco.	Twenty-two years, Sacramento.
	°	°
January	48.90	46.47
February	52.05	50.55
March	54.73	54.41
April	55.78	59.52
May	57.83	64.31
June	59.73	70.46
July	61.00	73.48
August	61.84	71.48
September	61.40	69.10
October	60.00	62.58
November	56.18	53.56
December	50.33	47.05
Mean for twenty-four and twenty-two years	56.65	60.25

THE CLIMATE OF SAN FRANCISCO.

By HENRY GIBBONS, Sr., M. D.

The reader will be able to obtain, by an analysis of the accompanying tables, a tolerably fair idea of the climate of San Francisco. The following conclusions may be stated:

The year covered by the report was decidedly colder than the average—*i. e.*, one and a half degrees, which is one and a half degrees for every day in the year.

January, the coldest month (forty-seven degrees), was but thirteen degrees colder than August (sixty degrees), the warmest month.

The highest temperature in any one month was is June (eighty-five degrees); the next highest in May (eighty-two degrees); but in no other month did the thermometer rise above seventy-six degrees. The warmest weather of the year is generally in September; sometimes in October, when the sea breeze abates.

The warmest night of the year was sixty-six degrees (at ten P. M.), and the warmest morning was sixty-eight degrees (at sunrise). This is a fair representation of the climate from year to year. It is very seldom warm enough in the evening to sit out of doors with comfort, and never too warm at night to sleep without blankets.

The change in temperature from noon to night is rapid, though the range is small, being only eight or ten degrees. The temperature falls but little during the night. This is the case not only during the prevalence of the sea breeze, which prevents both noonday heat and extreme cold at night, but in the Winter months, when there is no sea breeze.

East winds are almost unknown. The duration of east and northeast winds for the entire year was but five days. From the first of June to the first of October, the wind scarcely ever is from the northern half of the compass for a single moment. The south and southeast wind prevails only in the Winter, and is the rain-wind.

Table III shows that mornings and evenings are comparatively calm throughout the year, and that the reverse occurs in the afternoons during the Summer months. The sea breeze is seldom unpleasant till eleven or twelve o'clock, and it generally subsides at sunset.

Table IV shows that the sky is much overcast in July, August, and September, which are the months in which the mist comes in from the ocean. The sky may be said to be fickle at all times in regard to clouds, seldom remaining completely obscured for twenty-four successive hours. About one half the days in the three months above named have more or less mist, which appears toward sunset, and disappears mostly in the night.

The quantity of rain was about the average, though it was distributed over a greater number of days than common. In this respect the Winter, so called, was exceptionably wet. The quantity of rain in June was extraordinary. The whole quantity for twenty-four years, in the months of June, July, and August, was two inches, or an average of

less than three hundredths of an inch per year to each month. The smallest quantity of rain in any season for twenty-four years was in eighteen hundred and fifty-fifty-one, seven inches. The greatest quantity was in eighteen hundred and sixty-seven–sixty eight, 40.5 inches.

Table V, which covers twenty-four years, may be regarded as an established measure of the climate, as to temperature. It will be observed that the mean temperature from June first to October thirty-first, is remarkably uniform. The descent is abrupt from November to December, and the rise commences with February, much earlier than on the Atlantic face of the continent.

TABLE I.

Showing, for each month in the year, the mean temperature at sunrise, at noon, and at ten P. M.; the mean of extremes and the maximum, minimum, and range; the maximum at sunrise and at ten P. M., and the minimum at noon.

	1873.						1874.						Year
	July	August	September	October	November	December	January	February	March	April	May	June	
Sunrise	52 35	54.71	53.47	51.65	51.60	46.16	43.20	43.39	45.19	50.63	53.03	53 10	49.87
Noon	63.03	65.32	63.97	65.81	61.03	51.68	51.03	54.71	54.39	60.77	62.97	64.97	60.72
Ten P. M.	53.68	56.35	54.67	55.61	54.67	48.71	46 03	47.68	48.84	51.90	54.51	54.37	52.25
Mean extrem's	57.69	60.01	58.72	58.73	56.32	48.92	47.11	49.05	49.79	55.70	58 00	59.03	54.94
Maximum	73.00	75.00	72.00	76.00	72 00	57.00	59.00	65.00	65.00	73.00	82.00	85.00	85.00
Minimum	50.00	52 00	52 00	44.00	45 00	32.00	30.00	38.00	33.00	45.00	50.00	50.00	30.00
Range	23.00	23.00	20.00	32.00	27.00	25.00	29.00	27.00	32.00	28.00	32.00	25.00	55.00
Max. sunrise	54.00	60.00	56.00	62.00	60.00	55.00	55.00	50.00	54.00	58.00	62.00	68.00	68.00
Max. ten P. M.	56.00	61.00	61.00	62.00	64.00	55 00	60.00	54.00	57.00	60.00	66.00	65.00	66.00
Minim'm noon	58.00	60.00	60.00	60.00	54.00	42.00	44.00	50.00	48.00	54.00	55.00	58.00	42.00

TABLE II.

Showing the prevailing winds of each month in the year, or the amount of time, in days, during which the wind came from the several quarters of the compass.

	1873.						1874.						Year
	July	August	September	October	November	December	January	February	March	April	May	June	
N. and N. W.	0	0	0	12	12	8	21	16	10	5	2	0	84
E. and N. E.	0	0	0	0	0	3	1	0	0	1	0	0	5
S. and S. E.	1	1	3	4	5	14	6	6	6	4	3	1	53
W. and S. W.	30	30	27	15	13	6	3	6	15	20	26	29	223

TABLE III.

Showing the relative force of the wind in the forenoon, in the afternoon, and in the evening, during each month in the year. The figure 1 represents a very light current of one or two miles an hour; 2, a current of five miles; 3, of ten; 4, of fifteen; 5, of twenty; 6, of thirty; 7, of forty, etc.

	1873.						1874.						
	July	August	September	October	November	December	January	February	March	April	May	June	Mean
Morning	1.94	2.10	1.87	1.48	1.37	1.58	1.21	1.32	2 16	1.97	3.00	2.93	1.91
Afternoon	4.94	5.10	4.93	2.71	2.17	1.81	1.94	2.11	3.13	3.57	4.32	5.10	3.49
Evening	2.77	2.00	2.23	1.26	1.10	1.42	1.45	0.97	1.26	1.70	2.20	2.37	1.71
Mean	3.22	3.07	3.01	1 82	1.55	1.60	1.53	1.47	2.18	2.41	3.17	3.47	2.37

TABLE IV.

Showing, for each month and for the year, the proportion of time in which the sky was clouded, and the proportion of clear sky; the number of days completely or nearly cloudy throughout, and the number clear; the number of days in which rain fell, and the quantity, in inches.

	1873.						1874.						
	July	August	September	October	November	December	January	February	March	April	May	June	Year
Pro'n cl'dy sky.	13	14	14	9	10	16	15	9	12	10	10	6	138
Prop'n cl'r sky.	18	17	16	22	20	15	16	19	19	20	21	24	227
Whole days cl'	1	2	1	0	4	10	7	3	3	1	2	1	35
Whole days c'r	8	6	9	18	11	3	9	13	9	12	13	15	126
Days of rain ...	1	0	0	2	4	16	13	9	13	7	4	2	71
Quantity rain...	00.01	00.00	00.00	00.32	1.20	9.50	5.25	2.48	3.50	00.80	00.64	24.48	24.48

TABLE V.

Showing the mean temperature of each month, for twenty-four years.

January	48.90	July	61.00
February	52.05	August	61.84
March	54.73	September	61.40
April	55.78	October	60.00
May	57.83	November	56.18
June	59.73	December	50.33
Mean			56.65

Malarial Fevers and Consumption in California,

In their relations with irrigation, drainage, cultivation of the soil, and impounding of water in reservoirs, etc., and the means of modifying or counteracting their prevalence—comprising the substance of a paper read before a joint meeting of the "Sacramento Society for Medical Improvement," and the "State Board of Health," on the twentieth of January, eighteen hundred and seventy-five.

By THOS. M. LOGAN, M. D.

Desirous of obtaining as much as possible of the information which may have accrued since the American occupation of California, respecting the effects of settlement, cultivation, drainage, irrigation, mining operations, aqueducts, reservoirs, forest and tree culture—especially of the *eucalyptus globulus* or Australian gum tree—upon the general sanitary condition of the inhabitants, more particularly with a view of discovering some means of controlling, or, at least, of modifying the influence of malaria in the production of fevers, and also of determining, by the *vote* of representative men, both in and out of the medical profession, the prevalence of consumption in each section of the State, in its relations with soil-moisture, unaffected by immigration or emigration, likewise the best climates and localities for the amelioration of its special types and stages—I issued a circular, some months since, arranged for categorical responses to these important questions. I now propose to call the attention of this society to some of the conclusions that have already been arrived at, and to request, that in lieu of the customary impromptu discussion coincident to the reading of our monthly essays, the whole matter, as now about to be introduced, be taken under advisement, so as to afford each member the opportunity of writing out fully his matured thoughts and opinions, for presentation at some future meeting. And, furthermore, I respectfully ask that I may be permitted to appropriate this paper, together with the remarks it may draw forth, to the public use and benefit, in the pages of the Report of the State Board of Health.

Extended answers or criticisms of what I have now to say, striking examples in illustration of theories or monographs on any subject germane to the inquiries therein propounded, provided they are written in a compact manner, will be gladly received.

I trust it will not be thought that I am asking too much. It was for such purposes this society was formed—to bring the members into harmonious coöperation; to cause mind to bear on mind; to work out the problem of climatic and topographical influences on the physical con-

dition of the people of this State; to determine the best methods of holding life and health in integrity; and to remedy the evils incident to existence. These I conceive to be its prominent aims. Relying, therefore, upon that professional spirit for which this society has ever been distinguished, and which has already gained for it a name and a place among the scientific institutions of our country, I will proceed to the discussion of those special subjects on which I more particularly desire to have the benefit of your experience and knowledge. And now let me direct your attention to the subject of—

MALARIAL FEVERS AND CONSUMPTION IN CALIFORNIA.

If any fact has been well established by the sickness and mortality statistics of the State Board of Health, it is that malarial fevers and consumption constitute the most prevalent forms of disease—the latter being the most aggravated cause of death in California.

Let us look into this statement seriatim, and if we cannot pierce the misty vail, which obscures the etiology of these diseases, we may yet be enabled, through our united experience, to suggest, at least, some means of controlling, if not of preventing their prevalency and fatality.

MALARIAL FEVERS.

The vital statistics of the last United States decennial census confirm what has just been stated as the result of the investigations of the State Board of Health, viz: that the whole State is more or less subjected to malarial fevers. Under the general term "typho-malarial," I have included in the mortality statistics all the varying forms of these fevers supposed to be dependent on one and the same poison—the different grades, described by medical writers, from the simple intermittent to the continued and pernicious, bearing a pretty direct ratio to the intensity of the poison.

According to the former authority the maximum mortality by these fevers is found to occur in Sacramento, Amador, El Dorado, and Placer Counties, and also, in the northern part of the Sacramento Valley, and all the northeast corner of the State—the rate of mortality being from five and one half to nine per cent of all causes of death. This closely coincides with the data published in the second biennial report of the State Board of Health, which shows a somewhat greater mortality in Marysville, where it is fifteen per cent, and in Placerville, where it is the same; and also in Colusa and surroundings, where it is about twelve per cent. A lesser rate of mortality, from two and one half to five and one half per cent is found, according to both these authorities, in Marin, Solano, Napa, Yolo, Nevada, and Sierra Counties, in the mountains, the lower part of the San Joaquin Valley, and the region about the Bay of San Francisco—the peninsula itself of San Francisco enjoying an almost entire immunity.

NATURE AND CAUSES OF MALARIAL POISON.

Up to this time but little is known, according to the latest authority (1), of the nature of malarial poison. The older observers (Mascati,

(1) Ziemssen Cyclopædia, vol. 2, 1875.

Vaucquelin, Fontanelle), merely demonstrated the presence of decomposing organic matter in marsh-exhalations, and the theory has long been generally accepted that malarial poison is exclusively the result, in gaseous form, of the decomposition of vegetable organisms, such as carbonic acid gas, carbureted hydrogen, and according to Schwalbe, carbonic oxysulphide.

But although no analysis of the air has yet disclosed any immediate principle to which the unhealthy influence of malaria or marsh-miasm may be ascribed, still, if we admit its existence as the efficient cause of the disease in question, it is easy to see why the rates of mortality by these fevers in California, thus determined by positive statistics, are just in the proportion in which they are found in certain parts of the State. A rich alluvial soil, abundant vegetation, rivers and creeks whose banks are subject to overflow, and inundations of vast prairie lands, which every year occur to a greater or less extent—these conditions, conjoined with a high Summer temperature, together with sudden and sharp transitions from the heat of mid-day to chilling nights, are the well recognized hypothetical factors concerned in the production of malaria; and it is precisely in those regions where the greatest mortality and sickness, caused by malarial diseases, as just seen, happens, that the concurrence of all the conditions, just enumerated, is met with in the fullest degree. Of all the elements which enter into the sum of these conditions, water seems to play the most active part.

Geographical facts, collected by medical writers from Hippocrates downwards, show that every country is unhealthy in proportion to the quantity of undrained alluvial soil it contains; the inhabitants of such districts dying often in the ratio of one in twenty, instead of one in thirty-eight—the average mortality in healthy countries. Ancient Rome was once the seat of so many fatal epidemics that the Romans erected a temple to the goddess Febris. Those epidemics were known to arise from the great masses of water, poured down from the Palatine, Aventine, and Tarpein hills, becoming stagnant in the plains below, and converting them into swamps and marshes. The elder Tarquin ordered them to be drained, and led their waters by means of sewers to the Tiber. These subterranean conduits ramified in every direction under the city, and this system of drainage, which was continued as late as the Cæsars, rendered Rome proportionably healthy, and the seat of a larger population than has since, perhaps, been collected within the walls of any city. On the invasion of the Goths and Vandals, however, the public buildings were destroyed, the embankments of the Tiber broken down, the aqueducts laid in ruins, the sewers obstructed and filled up, and, the whole country being now again overflowed, Rome once more became the seat of an almost annual paludal fever, as in the times of her earliest foundation.

Referring to the numerous facts of a similar nature bearing upon the etiology of fevers, and which are to be found in the works of Lancisi, Baglivi, Rigault de L'Isle, Maccullock, Furguson, Rush, and a host of writers, I would here remark that it appears, from an extensive investigation of the subject, several years ago, by the English General Board of Health, the conclusion was arrived at that wherever water is laid on the land in greater quantities than it can immediately or very soon absorb, or wherever there is alternate wetting and drying, the effects of malaria, if other conditions be favorable, are sure to be manifested. Instances upon instances have been brought forward, not only from England, but from other countries where irrigation is practiced, of the

appearance and disappearance of fevers coincident with the operations of flooding and drying particular tracts of land. In the Lombardo-Venetian provinces, where there is some of the oldest, most extensive, and skillfully conducted irrigation in Europe, the Government long ago found it necessary to interfere for the protection of the health of towns. By law, as stated on positive information received by the same high source, just referred to, from the authorities at Milan, "permanent" irrigations are prohibited within five miles distance of towns. This range, that has been assigned by experience and predicated upon the most carefully observed facts, to the influence of malaria so far beyond its source or origin, taken in connection with the numerous instances, resting upon the most respectable authorities, of the febrile cause being borne in the common atmosphere, as, for instance, from Holland to England—of ships receiving the infection at a great distance from land—together with the collateral evidence afforded in Europe, from the frontiers of Asia to the other extremity of that continent, and particularly in Italy, that as the western coast presents a larger surface of infections, so malarial fevers prevail more extensively under the influence of southwest winds than of the opposite currents. All these corroborating circumstances not only tend to render it highly probable that the noxious agent must be a product of vegetable decomposition changed from a fixed to an æriform state, and evolved in the lower regions of the atmosphere, and to place the question of the morbific effect, at a distance, of winds passing over pestiferous localities almost beyond the possibility of a doubt, but also satisfactorily account for the diffusion of malarial fevers throughout the length and breadth of this State [1]—disseminated from the generating foci, the watercourses, sloughs, reservoirs, etc., in all directions, just as they happen to be located.

Indeed, if facts were wanting to establish the point in all the hypotheses which have been framed, concerning the etiology of these fevers, that moisture, at a given temperature, is one of the essential elements in the production of its remote causes, and that these causes can be wafted to great distances from their sources, the medical history of our State abundantly supplies.

MEDICAL HISTORY, ETC.

In reproducing, therefore, in part, for the benefit of the public, for whom the publications of the State Board of Health are prepared, what was advanced by me in eighteen hundred and sixty-five, in my report to the American Medical Association, I will hear repeat that, prior to the Fall of eighteen hundred and fifty-eight, when autumnal fever prevailed so extensively, the plains, as well as the mountains of California, were proverbial for their salubrity. With the exception of the irregular development of confused forms of fever in towns and isolated localities, chiefly where stagnant water existed, and of intermittents in the neighborhood of exposed river-courses and low places, which are inundated

(1) Lancisi was among the early writers, already referred to, who recognized the agency of the wind in aiding the spread of malarial fevers by virtue of its power of carrying material disease-germs. He attributes to the influence of the winds the fact that the Roman Campagna became more unwholesome after the removal of the sacred groves, and its consequent greater exposure to the miasm of the Pontine marshes. Similar testimony may be found in all ages, and of the most varied kind.

during certain portions of the year, endemic diseases were comparatively unknown—at least after the introduction of the comforts and ameliorations of civilized life, and when men ceased to overtask and expose themselves in the reckless manner peculiar to the earlier immigrants. But how stands the case now? An extensive system of irrigation has been inaugurated in the Tulare, San Joaquin, and Sacramento Valleys for agricultural purposes, which, unless the contemplated drainage be carried out in the most thorough manner, in accordance with the precautionary suggestions of the Board of Government Commissioners, will render our wheat fields no mean rivals, in unhealthfulness, of the notoriously miasmatic rice fields of our Southern States.

For mining purposes, canals, thousands of miles in aggregate length, have already been dug in all directions, without a thought as to alignment or drainage, to lead the water in innumerable serpentine courses from the rivers into the placers, towns, and settlements, and nearly every valley that can be dammed on the line of these ditches has been appropriated as reservoirs to hold water. The action of an almost tropical sun upon the decaying vegetable matter that remains in these canals and reservoirs, especially around their margins, has been manifested in its effects. Not only in the plains and agricultural regions, but along the whole range of the foothills, from Shasta to Merced, as indicated in the accompanying map, malarial fevers prevail more or less every Fall. In eighteen hundred and fifty-eight, so universal was the endemic that it might have been properly termed an epidemic. At Folsom and in the neighboring country, previously regarded as particularly free from miasmatic diseases, scarcely a miner escaped. In Placer the effects were most alarming, not in fatality, but in extent. The following paragraph from the *Placer Press*, published in Auburn, gives a concise explanation of the circumstance:

"Almost everybody living west from Gold Hill is either down with fever, or chills and fever, or more or less affected by the miasmatic poison generated and floating around in that locality. The cause of this unusual sickness is generally chargeable to the reservoirs of the several ditches. They are filled with sedimentary water, which spreads over a large plain during the day, exposing a great surface of wet vegetable matter to the sun, as the water is drawn down. This is a most unfortunate fact, as without reservoirs the county cannot be mined, and sickness destroys the ability to labor. What can be done to remedy the evil?"

To show further that I am not drawing upon imagination to make out a case of deep and pervading interest, but stating actual facts, patent and accessible to every one, I will here cite a few other statements from the newspapers of that period, as affording the best historical record of past events:

The *Citizen*, published at Monte Christo, after noticing the extraordinary fact, clearly indicating a pestilential constitution of the atmosphere, of an almost universal tendency of every bruise, cut, applications for neuralgia and rheumatism, such as blisters, etc., to result in the formation of abscesses, alludes, likewise, to the "general prevalence of sickness."

The *Butte Record*, of Oroville, at the same time, stated: "The work on the deep shaft has been suspended, in consequence of illness among the company that has it in charge. A great deal of sickness exists among the bluff miners, more than any previous year." About the

same period the following card, addressed by the citizens of Oroville to the editor, appeared:

"The undersigned, citizens of the Town of Oroville, having witnessed with deep regret, during the past month, the sickness which (heretofore unknown to us) is this Fall afflicting nine tenths of our people, injuring business, and which now threatens to impede the future growth and prosperity of our town, (1) would respectfully suggest that, as it is now a conceded fact that our sickness is the result of inhaling the miasma arising from the stagnant waters to the south and west of the city, a meeting be called at the Court House, on Tuesday evening, October nineteenth, at seven o'clock P. M., for the purpose of taking steps to remove the nuisance."

The same paper has the following remarks:

"The successful working of the river claims demands a longer season of dry weather; the health of the country seems to require rain. Health is of vastly more consequence than the accumulation of gold, and we pray for rain even at the expense of the river miners. * * * Accounts from other sections of the State show that this region is not the only one infected. Similar complaints to those experienced here prevail along the Yuba and in many of the mining and agricultural districts of the foothills."

Unfortunately for the future welfare and prosperity of this town, the unusual occurrence of the most copious rains ever experienced in October, followed by heavy frosts, obviated for the time being the necessity of the active steps called for, and nothing has since been attempted, either in that locality or elsewhere, to prevent a repetition of the same calamities. The conditions favorable to the evolvement of the febrile poison, although interrupted at that time by the change of season, remain not only the same but are renewed every year, over a wider field, with more or less potency.(2) In fact, in no other country or epoch in the world's history than in California at the present time has man's action ever been known to change so rapidly or so permanently the face of nature. Millions of tons of soil are washed down annually through the Sacramento and American Rivers and their tributaries. Each ton of soil so transposed by the hydraulic ram not only incapacitates a certain area of high land for the growth of timber and other vegetation but also tends to raise the river bottoms. And although the terrible effects of outraged nature which the history of analagous civilizations and circumstances teaches have not yet manifested themselves strongly enough to arrest general attention, still it is only a question of time when, by the denudation of our mountain slopes of their forest growth, a more rapid melting of their snow must follow, and consequently increased frequency and violence of freshets and coincident floodings of the low lands. Unless, therefore, some effort is made towards correcting and providing against the evils resulting, in a sanitary point of view, from the present and prospective modes of spreading water over the surface, the most valuable portion of California will become more and more obnoxious to the health of the inhabitants during the autumnal months. It is due, therefore, to the State, with whose general prosperity and welfare our own interests are identified, and

(1) The soundness of these predictions have been confirmed by time.

(2) See the account of the late epidemic, in this report, among the Chinese on the Feather River, near Oroville.

especially is it due to the science we cultivate, that the sanitary bearings of this subject should be investigated in a philosophical manner, especially by the State Board of Health and the members of this society, most of whom have been living in the midst of the malarial region for nearly a quarter of a century. We can all speak of these diseases from direct practical experience; and taking it for granted that every one admits of the existence of its cause in the atmosphere, I trust that, by thus directing attention to the conditions already stated to be connected with its evolvement, to elicit your opinions, either to confirm or invalidate whatever I may further advance. In this manner I may be enabled to diffuse, through the reports of the State Board of Health, some sound practical knowledge on a subject of deep import, as well to the science of medicine as to that of political economy.

The question which naturally suggests itself here is: If water has the agency attributed to it in the production of the toxical effects under consideration, what are the concurrent circumstances necessary to give it potency or efficiency?

MEDICAL TOPOGRAPHY AND HYDROGRAPHY

supply many facts which go to show that though malarial fever prevails perpetually and virulently within the tropics, there are still places having the same temperature, but varying in other conditions, that are never affected by it. The Summer heat of our southern desert is intense, but those who traverse it and keep at a distance from its watercourses remain perfectly healthy.

Everywhere west of the States of Arkansas, Missouri, and Iowa, surface water is scarce, the declivity of the plain, which stretches from the Rocky Mountains, favoring its escape, while the subjacent sand absorbs even considerable rivers. Thus, as we advance into the desert, we come at the same time to the limits of surface water and malarial fever. That the heat here is sufficient to engender malaria, if that was the only necessary condition, is proved from the fact, that far to the north of this region, where the whole country is essentially lacustrine, the fever prevails. Thus the shores of Lake Ontario and Erie, with those of the southern extremity of Huron and Michigan, are infested, and suffer far more than the drier lands which surround them. Beyond those limits, on the shores of the two latter lakes, and on those of Lake Superior, the fever is never epidemic, although water is abundant. Still further north, where small lakes and their connecting streams exist in countless numbers, the disease is unknown, while under precisely the same conditions in Florida, Alabama, Mississippi, Louisiana, Texas, Illinois, Tennessee, Kentucky, Indiana, Ohio, and other States, it never fails to show itself in Autumn. These facts show that water and a certain degree of heat are essential to the production of the disease. From the diligent study of these hypothetical causes, and their comparison with other instructive facts furnished by our army statistics, the late Dr. Daniel Drake inferred that a mean annual temperature of sixty degrees is necessary for the production of the fever, and that it will not prevail, as an epidemic, where the temperature of the season falls below sixty-five degrees. The following is an abstract of some of the conclusions, as to the modus operandi of these agents, arrived at by the same high authority just quoted:

"Surface water not only contributes largely to the production of a luxurious vegetation destined annually to perish, but is indispensable to

the decomposition of what it has aided in producing. Hence, without the agency of water and heat, none of the deleterious gases, which are supposed to be thus generated, could have an existence.

"But the presence of water in any or all quantities will not answer equally well. If there be too little, the molecular movements of fermentation are arrested for want of a solvent; if too much, the atmosphere, indispensable to the process, is excluded, or the evolved gases are absolved and retained.

"The combined agency of moisture and heat not only facilitate the multiplication of minute but visible animals and cryptogamic plants, but also may be presumed to multiply the microscopic, both animal and vegetable.

"Under the influence of solar heat, water impregnates the air with vapor, giving a high dew point; and, other circumstances being equal, the evaporation is greatest where the heat is highest."

Adopting these conditions, which are based upon the position already assumed by me, of the existence of a specific ærial poison as the cause of malarial fever, I pass on to show that another essential condition, viz: a Summer temperature of sixty-five degrees is to be found also in California, sustaining the same correlation with water or moisture here as has been observed elsewhere in the production of the morbific agent.

The results of meteorological observations made during the last twenty-two years at Sacramento and other points, establish the fact that the climate of the immense Sacramento, San Joaquin, and Tulare Valleys, which the Commissioners of Irrigation very properly call the "Great Valley of California," appears to vary as little as its geographical formation. It is true that the Winters are severer in the higher and more elevated portions, but this is counterbalanced by a considerable increase of Summer heat, which makes the annual average of temperature the same. Thus it will be seen, on the accompanying map, that the isothermal line of 60° reaches from Millerton, latitude 37°, to further north than Redding, even to Shasta, latitude 40° 35′. It is also seen that the isotheral line of 70°–75° traverses the same direction, and even goes further north than Redding. Indeed, the Summer heat of the elevated portions of the valley is often intense, reaching at times not unfrequently to 110°. At Coloma I have seen the thermometer read as high as 107°, when as well protected as could be against either reflected or radiated heat, and I have good reason to believe that high up in the foothills the heat is more intense than in the lower part of the valley.

The general simultaneous rise of the rivers, which water this whole region, seem to show that their supplies are affected by the same climatic influences, not only in respect to the precipitation of rain, but also the melting of the snow at their sources. Hence it is seen that so far as heat and moisture are concerned in the production of malaria, these elements exist in the elevated, as well as in the lower parts of the entire valley.

It is probably owing, in a great measure, to the great excess of temperature, that malignant or congestive forms of fever are sometimes met with in the elevated northwestern part of the State. But it must be remembered that, just as it happens on the summits of other rocky countries, as Gibralter and the Ionian Islands for instance, where severe malarial fevers prevail, here also springs arise. The slightest frost produces fissures into which mould and vegetable matters insinuate themselves, while the bare rock becomes heated to an intense degree. The intense heat of the sun, likewise, acting just as the frost, may cause cracks and deep rifts in the earth, which might give free exit to the miasm from beneath. Whether similar conditions will be found to exist, explaining the origin of "mountain fever," is not yet determined. Humboldt, on ascending the Orinoco, found the station at the great fall depopulated by fever, which the natives attributed to the bare rocks of the rapids. He determined the heat of these rocks to be 118.4° Fahr., while the temperature of the air immediately around was only 78.8° Fahr. Again, the rock of Gibralter is known to be percolated with water, so that we can hardly conceive of a more pestilential focus of disease, when the chemical causes necessary to the formation of miasm are combined. The existence of paludal fevers in the dry and rocky districts of our State, therefore, although it may appear extraordinary and unexpected, is not necessarily an exception to the general laws of such diseases being generated by miasmata, the result of vegetable decomposition. For if heat and moisture were sufficient to account, *per se*, for the occurrence of these fevers, we would find them prevailing out at sea, in all the temperate and tropical latitudes, among seamen. But this does not happen, whatever may be the temperature under which they cruise. It is when they approach the coast, or land upon it, that seamen are attacked. It may also be here remarked, that in places occasionally subject to the disease in various grades of intensity, sickly seasons are not necessarily characterized by a higher dew-point than the corresponding periods of other years in which the disease does not prevail to any extent. We may, therefore, safely adopt a further conclusion of the same authority just quoted, that, besides heat and moisture, there is another obvious condition, which is necessary to the production of malarial fevers, viz: dead organic matter resting on, or blended with the mineral elements of the soil.

Although the evidence regarding the geological nature of soil as a cause of fever is somewhat conflicting, still it is a fact that the usual localities, in which malarial fevers abound, are those in which the soil consists of mineral, vegetable, and animal matters, mixed together, in such proportions and of such constituents chemically as tend to absorb moisture and retain it, and subsequently to decompose. Such soils are known as *alluvial;* and that these constituents exist in our great valley to a considerable extent, and under circumstances favorable for the engendering of the morbific effect, will readily appear in the following

GEOLOGICAL AND TOPOGRAPHICAL SKETCH.

The area which has received the name of the "Great Valley of California," and which constitutes one of the five divisions of Central California, as laid down by Professor Whitney, lies inclosed between the separated, but inosculating, ranges of the Coast Mountains on the west, and the Sierra Nevada on the east, both having the same common trend. The Coast Mountains form a belt thirty to forty, and even fifty, miles wide, composed of several associated ranges, and having an altitude of from three thousand to eight thousand feet. The highest point in sight from San Francisco is Mount Hamilton, about fifteen miles east from San José. This is four thousand four hundred and forty feet high, or just ten thousand feet less than Mount Shasta. Monte Diablo, although five hundred and eighty-four feet lower, is a much more conspicuous object. North and south of the central portion, the coast

ranges rise higher as they approach the Sierra in each direction, and the highest points attain as much as eight thousand feet. The coast ranges are composed, for the most part, of volcanic rocks, trap, trachyte, and pumice, with occasional protrusions of granite and serpentine. Their flanks, on either side, are interruptedly occupied by tertiary sandstones, and by volcanic marls and tufas of still more recent date—the sandstones containing characteristic miocene fossils; the finer marls containing infusoria, generally of fresh water origin. What gives its peculiar character to the Coast Range, according to Professor Whitney, is the delicate carving of their masses by the aqueous erosion of the soft material of which they are composed. In early Spring the slopes are of the most vivid green; Spring, here, commencing with the end of Summer. Winter there is none. Summer, blazing Summer, tempered by the ocean fogs and breezes, is followed by a long six months Spring, which, in its turn, passes almost instantaneously away at the approach of another Summer. As soon as the dry season sets in, the herbage withers under the sun's desiccating rays, and the slopes remain bare for six months in the year.

The Sierra Nevada Range, so called from the perpetual snow on its summits, owes its origin probably to the same general system of elevation and nearly the same date as the Coast Mountains—*i. e.*, subsequent to the deposition of some of the tertiary strata. The great mass is composed of plutonic or volcanic rock, granite, gneiss, mica-schists, and porphyries, trap, trachyte, etc., with auriferous talcose slates and veins of quartz. These strata having been extensively broken up and eroded by aqueous or glacial action, have, in the rearrangement of their constituent materials, given rise to the *placer* deposits which skirt the base of the range. A metamorphic limestone is found at intervals skirting the great valley, highly crystalline and containing no fossils. The surface of the plain between the ranges is underlaid by beds of transported material—gravel, clay, and tufaceous conglomerate—several hundred feet in thickness, which were once deposited as sediments on the bottom of the trough, but have been extensively rearranged by the present watercourses, and in many places subjected to considerable disturbance from volcanic action. Considering the Sierra to terminate on the north at Lassen's Peak, its length will be, according to Professor Whitney, about four hundred and fifty miles, and its breadth, taking the valleys of Walkers, Mono, and Honey Lakes as its eastern and the base of the foothills as its western limit, may be set down as averaging eighty miles. This width, however, is very unequally distributed between the two slopes; the western is much the most gradual, being nearly to the level of the sea; while the eastern is to the level of the Great Basin, some four thousand feet above tidewater. The western slope of the Sierra rises, in the central portion of the State, opposite Sacramento, at the average rate of about one hundred feet to a mile, the elevation of the passes being about seven thousand feet. From latitude 36° 32′ to 39° 45′ the dominating peaks sink from fifteen thousand to eight thousand four hundred feet, and the passes from twelve thousand to five thousand four hundred feet.

The climate of the Sierra Nevada varies, of course, with the altitude. The traveler, leaving San Francisco, will have to rise several thousand feet, on the flanks of these mountains, before he will come to a region where the mean temperature of Summer is as low as that city. As high up as eight thousand feet or ten thousand feet the days are quite comfortably warm. "On the very highest peaks, at elevations of

twelve thousand feet or thirteen thousand feet, we rarely," says Prof. Whitney, "felt the want of an overcoat at midday. An examination of our thermometrical observations shows that we had the mercury almost always over 80° in the Yosemite Valley, at an elevation of four thousand feet above the sea, during the six midday hours in June and July, although the nights were, almost without exception, cool enough to make a pair of heavy blankets desirable. * * * At the summit of Mount Dana, thirteen thousand two hundred and twenty-seven feet high, the temperature marked at noon was 43°; and on Red Mountain, at an elevation of twelve thousand feet, the thermometer stood at 58°." The high mountains of California receive, probably, their whole precipitation of moisture in the form of snow; and of this an enormous amount falls during the Winter months exclusively. It is the melting of this, in Summer, which keeps the streams full of water high up in the mountains, and these, in turn, furnish the canals or ditches which convey the indispensable supply for mining and agricultural purposes. These ditches are deep in proportion to their width, and have a rapid fall, so as to lessen the evaporation which so rapidly diminishes the quantity of water in the streams flowing naturally down the Sierra. From the summits of the higher peaks the snow seems to disappear by evaporation, rather than by actual melting. On the top of Mount Shasta, for instance, there is no indication of dampness. "Pieces of paper," says Prof. Whitney, "with the names of visitors written on them and laid in uncorked bottles, or on the rocks themselves, were found by us to have remained for years as fresh and free from mould or discoloration as when first left there." It is this peculiar dryness of the atmosphere which renders the mountain climate of California so beneficial in certain cases of consumption; and it is from this consideration that I have devoted so much space to the topography of this region.

Among these lofty ranges the inhabitants of the Mississippi Valley may seek refuge from the heated moisture of their debilitating Summer months; while the invalid from the eastern slope will exchange the chilling, damp east wind for the invigorating mountain breeze, and thus obtain a new lease of life. One of the greatest drawbacks from the benefits of traveling in the Swiss Alps, is the uncertainty of the weather and dampness of the climate. But here, at high altitudes, all through our California Alps, the weather during the Summer is almost always the finest possible for camping out, and for securing the advantages of *open-air* treatment.

Between the mountain walls just described, lies the great valley, as a broad plain, the central portion of which is scarcely raised above the level of the sea, while the remote ends are not more than twice as many feet above as they are miles distant from the center. The greater part of the fall of the draining streams being confined to the vicinity of the ends of the valley, as a consequence, through most of the length the current of these streams is slow, their course tortuous, and their borders, especially near their point of exit, are marshy, and covered with wide expanses of *tulé* (bulrush). The center of the valley is alluvium, with little diversity of level. The agricultural capabilities of the different parts of this valley, though influenced by the structure and constituents of the soil, which is generally fertile, but sometimes coarse and gravelly, or stony and barren, are, as is well known, more directly dependent on the degree in which its greatest want—the want of water—is supplied. With an abundance of this indispensable element, it would be one of the most productive portions of the globe. But if this want

is supplied by the system of irrigation which has already been inaugurated, it will inevitably become one of the most insalubrious. This question now recurs, what can be done, while reclaiming and fertilizing this immense agricultural region, to preserve the health of the inhabitants?

RELATIONS OF MEDICAL TOPOGRAPHY WITH MALARIAL FEVERS IN THE SACRAMENTO VALLEY.

Resuming the study of medical topography with reference to malarial fever in the great Mississippi Valley, I find, according to Dr. Drake, that it is a safe generalization to conclude that, all other circumstances being equal, fever prevails most where the amount of organic matter is greatest, and least where it is least. In valleys where it is washed down from the hills and deposited with the débris of rocks, this substance rapidly augments itself by promoting more luxurious crops of vegetation. Whereas, in the pine lands of our Southern Atlantic States, it is small in quantity from the sandiness of the surface, just as it is in our desert lands, where the fever is unknown.

Now, with respect to the Sacramento Valley, the amount of organic matter is found very different in different parts, for its production depends on the fertility of the soil, on temperature and moisture. Where these elements are all present, as in the neighborhood of our rivers, sloughs, and overflowed lands, and their agency is not counteracted by a growth of tulé or other vegetation, there we always find more or less of fever every year; indeed, it is an endemic of such localities. Especially do we find the disease most constant along those river courses whose turbid waters, being confined in the dry season within narrow bounds, leave a great part of their channels uncovered, and thus expose an immense amount of deposit brought down from the washings of the auriferous soil—as the Yuba, the Feather, and the American Rivers, and their tributaries. There are, however, regions of our valley where the loose upper stratum consists chiefly of the débris of rocks beneath, or of the deposits of the débris of other rocks spread over the surface by ancient inundations, and likewise tracts in which the rocks themselves appear at the surface. Here, owing to the rolling character of the surface, and the general declivity of the land, the organic matters are washed off by the rains of Winter into the innumerable ravines and channels of creeks and rivers with which the face of the country is diversified, and which, becoming dried up in Summer, the whole region has remained perfectly healthy. Since, however, the introduction of water for mining and agricultural purposes—the digging of ditches, the building of dams, and the establishment of large reservoirs—we find these very regions subjected to the disease; and this, too, we find to be in perfect accordance with all that has been observed in every part of the globe, where intermittents prevail. For it appears necessary to the production of the efficient cause, be it malaria, or whatever we please to term it, that there should be a surface capable of absorbing moisture, and this surface should be flooded and soaked with water, and then dried; and the higher the temperature, and the quicker the drying process, the more powerful—more powerful probably because more plentiful—is the effect. Hence the conclusion is legitimate, that decaying organic matter brought and deposited in various directions, in a condition and under circumstances most favorable to decomposition, has been instrumental in occasioning malarial fever in California. As to the mode in which this decaying organic matter coöperates with the other essen-

tially necessary conditions, heat and moisture, in the production of the morbific effect, we have no positive knowledge, nor would the discussion of the various hypotheses that have been framed in relation thereto, inure to any practical good. It may supply the material out of which a poisonous gas is formed, as maintained by some, or it may prove a nidus or hotbed for animalcules or vegetable germs, (1) according to the theories of others. Some, I must here take occasion to remark, attribute the poison to subterranean exhalations, to the gaseous effluvia from a volcanic soil. Still others deny any specific cause, or, again, believe it to consist in an accumulation or modification of the electricity of the earth and the air, although none of these views have been as yet established by sufficient proof; still we know the conditions that are necessary to give efficiency to the toxic agent, from whatever source it may be derived. As long as these conditions co-exist, certain effects are produced—interrupt, counteract their co-efficiency—and the probability is we may rid ourselves, to a great degree, of the annual recurrence of malarial fevers.

MODIFYING AND AMELIORATING CIRCUMSTANCES.

From the foregoing cursory examination of the conditions under which malarial fever has been developed in California, I hasten on to a further consideration of some of the circumstances and peculiarities attendant on its appearance here, and which have also been found by experience everywhere capable of controlling its evolvement or production.

Cities and large towns, it is well known, seldom suffer from malarial fever, and are to be considered as in some degree presenting opposite conditions to a sparsely settled country. As the buildings extend out, and the closely inhabited portions expand, and by so doing lessen the area of humid and exposed soil, the disease recedes. The medical history of New York, Buffalo, Auburn, Syracuse, Philadelphia, Charleston, Savannah, Louisville, etc., illustrates this. The statements of

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(1) This theory, says Dr. H. Von Ziemssen (Cyclop. Prac. Med., Vol. II, p. 585), has been brought forward again, of late, by various observers. *Thomas* (Archiv f. Heilkunde, VIII, p. 225). *Scoda* (Clinique Européenne, 1859, Canst. Jahresber, 1859, IV, p. 73), believes them to be either living or in a state of decomposition. *Baxa* (Wien. Med. Wochensehr, 1866, p. 78), saw low, cell-like structures in drinking water. *Balestra* (Compt. rend., LXXI, No. 3, p. 235), discovered a species of algæ in the Pontine marshes. *Salisbury* (Amer. Journ. Med. Sc., 1866, Jan., p. 51), found in his investigations in the valleys of the Ohio and Mississippi, that the sputa of the sick contained small elongated cells, presenting themselves singly or in rows, which he considered to be algæ-cells of the species palmella. These he also found and collected on glass plates set up over marshy ground, and in great quantities on the clods of an upturned marshy ground. According to his observation, these algæ-cells do not rise over one hundred feet above the level of the sea. He was able to produce the most intense attacks of intermittent fever by means of the fresh clods, if allowed to place them within the open window of a sleeping room in a house lying about three hundred feet high. The attacks, in four persons, the subjects of two experiments, followed in ten, twelve, and fourteen days, and were broken up by quinine. *Hannon* (Journ. de Med. de Bruxelles, 1866, Mar., p. 497), says that when he was devoting himself to the study of the sweet water algæ, during their fructification, he was attacked with an intermittent fever of six weeks duration. In opposition to Salisbury, *Harkness*, of Sacramento, states (Boston Med. and Surg. Journal, 1869, Jan. 14th), that he has found the palmella spores in the snow, and at the summit of the highest of the California Alps, and claims that they may very readily become mixed with the saliva and the urine from without—at the same time having nothing at all to do with malaria. Nevertheless, Ziemssen states that, on the Tuscan Appenines, fevers are to be found at the height of one thousand one hundred feet; on the Pyrenees, at five thousand feet; on the island of Ceylon, at six thousand five hundred feet; and in Peru, at ten thousand feet, and even eleven thousand feet.

Professor Yandell, relative to the last named city, are so apposite that we cannot refrain from quoting them in confirmation of our remarks.

"The rock, of which the subsoil is composed, forms a surface remarkable for its evenness; and the soil which it produces, as it crumbles under the action of the air, frost, and water, is peculiarly retentive of moisture. Ponds and slushes are abundant wherever the black slate constitutes the surface rock. The first houses erected at the fall, were built in the midst of ponds. Louisville, while it stood amid its ponds, was regarded as one of the most sickly towns in the Valley of the Mississippi. It was commonly called the 'graveyard of the west.' Intermittent fever was a regular annual visitant, and occasionally a form of bilious fever prevailed, rivaling yellow in malignity, and threatening to depopulate the town. The ponds have all disappeared—the streets have generally been paved, and though the grading is defective, and can never be as effectual for drainage as it might be rendered on a less even surface, still it is such as to carry off the rains into the river and the ditches south of the city. The only parts of Louisville (now) obnoxious to the charge of unhealthfulness, are its suburbs."

Now, with regard to Sacramento, whatever of reason there may be in the opinion formerly advanced by me, that the so-called cholera of eighteen hundred and fifty-two, when the city was in a transition-stage between country and a filthy, ill-conditioned town, traversed in all directions by sluggish, stagnant sloughs, was nothing more than a highly malignant form of malarial fever, there certainly, since a better order of things obtains, has not been witnessed, to the best of my knowledge, a single case of malignant fever within the city proper. All of the cases since met with here, have been of the simple intermittent variety, originating in the suburbs, and especially in that portion bordering on the American River, (1) where the amount of deposit is enormous.

That this modification, or mitigation, of the grave forms of malarial fever formerly met with is attributable, in a great measure, to the agency of similar sanitary measures to those just alluded to, respecting Louisville and other cities, will, I think, not be questioned by any one at all acquainted with the relative condition of the city then and now. In addition to the raising of the streets with sand above high-water mark, the better draining of the city, the filling up and damming of the sloughs against the ingress of water from the river, and the extensive building of houses, which intercept the action of the sun in low parts,

(1) Some idea may be formed of the immense amount of deposit brought down from the washings of the auriferous soil, above alluded to, when I state that on my arrival in Sacramento, in eighteen hundred and fifty, a large brig, named La Grange, was anchored in the middle of the mouth of the American River, to serve the purpose of a prison. Where that brig was anchored, there is now a road; what was then the mouth of the American River being completely filled up.

We are not aware that a sectional area-admeasurement of the Sacramento River has ever been made, but estimating the amount of water which passes down the river each second, during freshets, at three hundred and twenty-seven thousand six hundred cubic feet, we find, on an average, that there are carried in suspension past Sacramento City (a certain portion being deposited, as is shown by the elevation of the low as well as the high water marks on the rain gauge) thirty-eight thousand seven hundred and seventeen tons every hour, more or less, according to the stage of the American River—this affluent, owing to mining operations, being always most charged with detritus. The solid material, thus ascertained to be suspended in the water, is found on calculation to be sufficient to cover, in one year, a square mile, to the depth of two hundred and fifty-six feet. With these facts before us, it would seem that, if ever the ætiology of epidemics and endemics is to be solved by the present methods of topographical and meteorological research, the Sacramento River, with its tributaries and influences, must be paramount in unraveling the enigma of the diseases of its basin.

there has been a very general cultivation of shrubbery, and plantation of shade and fruit trees in the streets and gardens. From what has been observed respecting the protective power of trees and forests against malarious diseases, it cannot be doubted that this extensive arboriculture has exercised a powerfully controlling influence.

Besides shielding, from the solar rays, the humid surface of the earth, trees have been supposed, from the time of Pliny, to absorb insalubrious exhalations. Their beneficial effects are, we think, to be accounted for in this way more reasonably than by the obstacle or mere physical obstruction they offer, like a fence or wall, as conjectured by Lancisi and others. "This opinion," says Dr. R. La Roche, in his erudite treatise, controverting the supposed connection of pneumonia with autumnal fever, "this opinion has, to a certain extent, received the sanction of Thouvenelle, Copland, and other modern writers; and its correctness is rendered probable by the results of certain experiments made long ago, and repeated more recently to ascertain the fact." "Plants," says Julia de Fontenelle, "which Priestley had inclosed in glass jars filled with vitiated air, continued to thrive, and, at the end of a few days, this air had become as pure as that of the surrounding atmosphere." Dr. Lewis, of Mobile, adverting to the subject, remarks: "It is the generally received opinion, that living vegetation protects the human system from the deleterious effects of malaria; and reasoning by analogy, it would appear that experiments, made by scientific men, have satisfactorily explained the mutual dependence of the animal and vegetable kingdoms on each other for support. It has been ascertained that if air, rendered pernicious by respiration, be confined in a bottle into which some green plant has been introduced, and exposed to the action of the sun, the carbonic acid will be absorbed and the air restored to its original condition. The putrefaction of animal matter, and the decomposition of vegetable substances, would cause a sufficiency of carbonic acid vapor, when united with atmospheric air, to destroy every living being, were it not for this wise provision of nature. This gas, which is poisonous to the human as well as animal species, is a source of nutriment to every variety of plant; and thus, it would appear, exercises a benign influence in protecting men from the deleterious effects of poisonous vapors." "And if the effect," remarks La Roche, "is obtained, so far as regards one species of poisonous vapors, it may be equally so in reference to that giving rise to fever."

Many facts could here be collected, if the limits assigned to this article did not restrict me, to show that certain trees and vegetable productions, growing in damp, swampy, and malarial countries, possess the property of disinfecting them. The delta of the Mississippi, from the latitude of New Orleans down to the Gulf of Mexico, and west of the city, to its termination on the further side of Bayou Teche, abounds in lakes, and is traversed by a great number of small bayous. Herein are included the fine and flourishing settlements of the La Fourche, the Teche, and the Attakapas, all of which appear to be as little affected with autumnal or yellow fever as the Mississippi coast above the city. Nearly the whole surface of many of these bayous, and a considerable surface of many of these lakes, are covered in a greater or less degree with a great number of aquatic plants, both phænogamous as well as cryptogamous; but more especially with a large flowering plant, known by botanists under the name of *Jussieua grandiflora*, which grows three or four feet above the surface of the water, and gives the fallacious appearance of a natural meadow. To the influence of this plant Dr.

Cartwright ascribed the immunity of the region of country, where it grows, from fever; and adds, "I could find no other cause for the remarkable purity of the stagnant water in the lagoons, swamps, lakes, and bayous of lower Louisiana. * * * North of the region where the *Jussieua grandiflora* flourishes, there is the same kind of alluvial soil, formed by depositions of the identical rivers which form the soil of lower Louisiana; yet stagnant water, in hot weather, becomes exceedingly impure, beyond the limits in which the plant under consideration is found. The soil, therefore, cannot occasion the purity of the water of lower Louisiana, because the same kind of soil, a little further north, has not the same effect. I think it may be fairly inferred, therefore, that the aquatic plant consumes or feeds upon those substances which, in other situations, corrupt and vitiate stagnant waters in a warm climate."

It is not important to the point in view to know positively whether the healthfulness of the country just considered is due *exclusively* to this plant. The experiments of Maury with the sunflower (*helianthus*) go to show that other plants possess the same disinfectant property in malarial regions. But I allude more especially to the circumstance because of its relation to another fact of the same import in California. It was seen in our topographical sketch that the borders of the draining streams of the Sacramento Valley, especially near their point of exit, are marshy and overgrown with a wide expanse of *tulé* (*scirpus lacustris.*) This species of bulrush is very luxuriant, often attaining the height of eight to ten feet, and seldom less than six feet. It literally covers the swampy lands, and particularly all that extensive delta (as may be seen on the accompanying topographical map), formed by the union of the San Joaquin and Sacramento Rivers, before finding their way into Suisun Bay, at a break in the coast range. So far as our information extends, these *tularés*, or marshy lands, are exempt from malarial diseases.

A remarkable fact, specially worthy of insertion in this place, is one recorded in Sullivan's visit to Ceylon. "A large fresh-water lagoon, of a most green, slimy, tropical appearance, producing in abundance a lotus of almost Victoria Regia magnificence, stretches away to the back of the fort, and around are situated the bungalows of many of the Colombo merchants. The propinquity of this lake would, in any other tropical country, be considered as insuring a considerable amount of fever to the neighborhood; in fact, I doubt whether any advantage would induce a West Indian to locate in such position.

"However, in the matter of climate, Ceylon stands *per se*, and offers a total antithesis as regards the healthiness of certain districts of most other tropical countries. Whilst the vicinity of tanks and lagoons of the most fetid and aguish character is perfectly healthy, that of rivers is equally deadly. The apparent contradiction of the usual laws of nature is accounted for by two reasons. The tanks are covered with various kinds of aquatic plants, which, by a kind of providence, are made to serve not only as filterers and purifiers of the water itself, but even as consumers of a considerable portion of the noxious exhalations that would otherwise poison the neighborhood. The banks of the river, on the contrary, are rife with fever. The cause assigned is, that during the rainy seasons they swell to great size, and collect the vegetable matter of a large extent of country; but owing to the rapidity with which they fall at the commencement of the dry season, and the winding and intricate nature of their course, the streams are unable to clear

themselves, and this accumulation is left to decay in its bed and infest the surrounding country. There exists also another reason: the beds of the Ceylon rivers are almost invariably composed of sand, and the stream, instead of sweeping down the decomposed vegetable matter it holds in its waters, as must be the case in hard-bedded rivers, percolates through the sand, leaving the poisonous matter on the surface exposed to the burning rays of the tropical sun." As correlative, and calculated likewise to establish the protective power of trees also against malaria, I would mention in this connection another fact that once came within my own personal observation: Some thirty-five years ago, the streets of Charleston, South Carolina, were characterized by a very general growth of old umbrageous Pride of India trees (*Melia Azedarach*), whose cleanly verdure, free from, because poisonous to, insects, was as refreshing to the sight as the shade was grateful to the feelings during the almost tropical heat of the Summer months. But with the influx of northern merchants and Yankee enterprise came also the spirit of innovation, and this beautiful feature of one of our oldest southern cities was doomed to eradication by an ordinance of the City Fathers.

The very first Autumn after the extermination of the shade trees, the city, which had for many years enjoyed a perfect immunity from yellow fever, was afflicted with one of the most severe epidemics, and has been more or less subject ever since to an occasional return of the disease.

A distinguished natural philosopher—Changeux—inferred from the results of his experiments, that the action of trees and living vegetation in the production of the effect under consideration, is twofold. "Plants," he says, "whether odoriferous or inodoriferous, give issue to emanations which, when mixed with poisonous vapors exhaling from marshy or damp soils, neutralize their pernicious influence. But the former exercise a greater effect through means of the neutralizing process than by the power of absorption just mentioned, their emanations mixing with the air we breathe, and correcting its deleterious properties by virtue of the particular qualities with which they are endowed. The second class—the inodoriferous—on the other hand, act more, evidently, through the means of their power of absorption than the neutralizing property of their emanations, and remove from the air the vapors by which it is contaminated."

Senebier, in his *Physiologie Vegetale*, and other expert observers, ascribe the disinfection, not to the absorption by trees and other vegetable productions of the gaseous poison floating in the atmosphere of malarial localities, but to the purification of such an atmosphere through means of the large supply of oxygen obtained from living plants, and the neutralizing agency of that gas on the mephitic particles it meets with in insalubrious places. As to the manner in which the oxygen thus produced destroys or prevents the elaboration of the malarial poison, some difference of opinion exists. M. Carriere, in his excellent work *Le Climat de l'Italie sous le Rapport Hygiènique et Médical*, adopts the views of Chevreul and Fontaine, in relation to the formation of the febrific poison through means of the action of organic matter on the sulphates contained on the earth, or in water, with the aid of the oxygen derived from the former. According to Carriere, the leaves of plants, and of trees, as well as the green substances that cover the soil, are all inexhaustible sources of oxygen, which is so important to sustain life and preserve health. This fluid, thus furnished, offers an obstacle to the

action of organic matter. If the latter acts chemically on the sulphates, the other, in its turn, reacts on those compounds, and from the double antagonistic action thus produced, a state of equilibrium advantageous to the purity of the air and the salubrity is reëstablished. Hence, to cover the fields, the borders of marshes, indeed, the whole extent of the soil, with an abundant vegetation, is to place on the surface of insalubrious regions a reparative apparatus of the greatest power.

But whatever may be the way in which trees and other living vegetable productions operate in counteracting or neutralizing toxical agents, floating in the air, it is a generally conceded fact, that they do exercise a powerful influence in promoting the salubrity of malarial localities, and hence their plantation becomes an important part of agricultural economy. In urging, therefore, attention to their general cultivation, we cannot do better than condense the following remarks in relation thereto, from the work of M. Carriere, just quoted, which are as applicable to California as to Italy:

Dry soils should be covered with those trees which resist the wind, and grow on the sides of mountains, as the oak and all its varieties. The willow, laurel, etc., will suit best the humid parts of the plains. The culture of the pine, which contributes so much to the decoration of the peninsular landscape, as well as of all evergreen trees, deserves much more attention than it receives. But this, as it were, ærial vegetation, does not alone suffice. There is another species of vegetation which must not be forgotten because it creeps over the soil and mixes with the waters. It is necessary that the means for the production of oxygen should be spread wherever this fluid can act, down even in the lowest places, wherever chemical elaboration is at work. The cereals cover the whole extent of the meadows (*maremmes*), especially in the Roman States. But the harvest leaves the earth exposed, during the hot season, to the solar rays. It is unnecessary to observe that this condition favors the development of miasmata, and gives power to epidemics—for it is well known that the fevers of Autumn are the most grave. Hence it is apparent that some other culture than that of the cereals would be more favorable to salubrity. If the vine, for example, was spread over the plains, as is practiced in the south of France, the soil would be protected until late in the Autumn; for the vine preserves its leaves until after the maturation of the grapes. In cultivating it for this object, a predominance must be given to the green expansion, or, in other words, to the productive apparatus of oxygen. In Italy, especially, in the environs of Naples, this end is obtained by marrying, as it were, the vine to the willow, to the young elms, or to other kinds of trees, and thus prolonging the stems or main stalks (*les ceps*) by the multiplication of their points of support. (1)

(1) That such system of cultivating the grape in California is quite feasible, and was long ago recommended by me, the following extract from the *Sacramento Daily Union* of the twenty-second of February, eighteen hundred and fifty-nine, seems to establish:

"It is generally conceded that the citizens of our State have done more this season, in the way of planting grape vines, than in any previous year. Although the results will not be made manifest in the production of a crop immediately, yet the prospect is encouraging, in view of the successful development of the capabilities of our soil and an eventual supply of all our wants in this respect. Soil, suitable for the cultivation of the grape, is not confined to the valleys and plains of California, but may be found in every mining county of the State, and as extensive as the area of our gold fields. Indeed, it has been remarked that the grape raised on the sunny side of our mining hills is sweeter and more luscious, and produces a wine of more exquisite flavor, than the celebrated Los Angeles or Sonoma grape; or, other words, the latter grape is essentially improved in taste by being trans-

Besides these means, and in order the more effectually to subserve the cause of health, it would be advantageous to spread the alfalfa and other grasses, as the sedge, for instance, on the margins and in the beds even of the watercourses and canals, as well as on the dry land. By these means a product of oxygen would be gained, and stagnant waters and currents, with boggy margins, which stand so much in need of this gas, would not degenerate under the influence of the chemical decomposition of which they are the seat.

But the plantation of trees and shrubbery, and the general cultivation of the surface, are not the only modifying or ameliorating circumstances attending the improved salubrity of Sacramento, nor are these the only means of putting a stop to or mitigating the prevalence of fever or disease.

It is well known that since the season of eighteen hundred and sixty-seven–sixty-eight, there has been a considerable deficit in the annual average amount of rain in California; consequently, little or no stagnant water has remained in the sloughs or low places of the city, to pollute the vapor absorbed therefrom in the atmosphere, as was formerly the case. The effects, thus resulting from industrial as well as accidental causes, correspond precisely with the beneficial results obtained everywhere upon the draining of marshes, and the filling up of ditches, and other excavations, remarkable examples of which are on record. We might here dwell on the beneficial results of draining in Italy, Tuscany, France, and elsewhere, as well as on the effects produced by the covering of the marshy margins of river shores by sand-inundations, as observed on the borders of the Baltic, in Holland, in Africa, etc., and particularly on the well-known case of the Goodwin Sands, in which, while the usefulness of the land was destroyed, the salubrity of the vicinity was firmly established. We might also point out those instances in which the infection of a locality has been remedied by covering the focus of exhalation with earth, as was done in Gallipolis in seventeen hundred and ninety-six. But there are other considerations pressing upon our attention, and which will absorb all the space we can appropriate to the present subject.

In the foregoing remarks we have called attention to the salutary effects of perfect drainage, and of filling in, building up, and otherwise protecting by trees and vegetation low and humid places against the action of the solar rays, as exemplified in the sanatory condition of Sacramento. We now appeal to the past history of the same city, as affording one of the many instances on record, in which places, heretofore insalubrious, have been rendered otherwise by being thoroughly *washed*, as it were, through the agency of a freshet, or an inundation,

planted to favorable localities in the mountain region. To such an extent has the grape been cultivated in the mining country, that individuals have already commenced the manufacture of wine for the market, although they find a ready sale for a large portion of the grape crop in their immediate vicinity. On this subject we append the following remarks from the Coloma *Times:*

"'The adaptability of our soil and climate for the successful cultivation of the grape is becoming more and more apparent. Only a few years ago it was thought that the southern portion, only, of our State was adapted to its cultivation. Experiments, however, have proved that grapes of as fine size and of equal or better flavor can be, and are now, grown in the central and northern portions of the State than in the southern. In the mining counties, the grape culturists have, as a general thing, had no difficulty in disposing of their fruit; but now there are so many who have turned their attention to this business, they will have to go into the manufacture of wine in order to use up their crops.'"

which carries off all substances susceptible of decomposition, and leaves in their stead a deposit of innocuous materials.

In a former report, already referred to, we mentioned the extraordinary freshet that was precipitated from the mountains and hills of California upon Sacramento, on the second of April, eighteen hundred and fifty-three; the diluvial effect of which was increased by the sudden melting of the snows above. For a long time after the subsidence of the waters, the inhabitants lived in filth and discomfort, and the surface of the ground everywhere was covered with mud and river deposit. Everybody predicted unusual sickness, but, to the astonishment of all, the City of Sacramento, which was notoriously unhealthy prior to this period, then maintained the high character it now enjoys for salubrity, and which is incontestably established by the mortuary tables already referred to.

In turning to the Transactions of the Pennsylvania State Medical Society, we find analogous instances recorded of floods with like results. Prior to September, eighteen hundred and fifty, intermittent fever prevailed to a great extent along the course of the Schuylkill, and was found, in many instances, to be unmanageable, showing a tendency to a frequent recurrence. But since the flood, which took place at the time mentioned, the same localities have been remarkably free from it. The same cause and effect have been observed by us in Louisiana; after the great crevasses of May, eighteen hundred and sixteen, and eighteen hundred and forty-nine, the City of New Orleans and neighboring country enjoyed uninterrupted immunity from malarial fevers.

Gouraud, in his treatise on *Fièvres Intermittentes Pernicieuses*, states that the City of Avignon was inundated on the thirtieth of October and the fourth of November by a rise of the Rhone. Nine tenths of the city was under water. No fever, however, followed, owing to the complete washing which the surface underwent, and the supervention of the cool north winds, which wafted the morbid exhalations along the great valley of the Rhone out to sea. Other analogous facts are related by Vitruvius respecting the lagunes of Venice, especially around Ravenna, Altina, and Aquileia; by Johnson, on Tropical Climates, and by Nicol, on the Climate of Seringapatam. At this latter place materials for putrefaction, for about eight months of the year, lie all over the banks of water streams, and other repositories, "until the periodical rains of Malabar begin, which, falling in the Ghauts, run down, and fill the Convery River. The filling of this river is always very sudden, and it comes rushing along with great impetuosity; sweeps out all the filth from the ditches, clears away all the impurities so long stagnant on the island, and leaves the place for a while tolerably healthy, and the air cool and refreshing." With equal propriety we may here call attention to the results obtained in some parts of the Pontine marshes, as well as in and about the Eternal City, as compiled by La Roche, from the writings of Tournon, Carriere, and others.

"In former days, that part of Rome on which the immense population was crowded, and which is now almost deserted, was healthy—comparatively so at least—while the insalubrious sections were the Campus Martius, the Velabrum, and other parts bordering on the river—the site of the modern city. The reverse is now the case; for as we approach the inhabited parts of the present city, through the space separating St. John of Lateran from the Forum and Velabrum, we pass over the principal focus of the pestiferous exhalations. On the other hand, the surface of the Campus Martius, or, indeed, the whole valley, is free from

the tainted atmosphere. The very section appropriated to the Jews—the Guetto—where the principles of public hygiene are sadly neglected, is, to a great degree, healthy. How has this happened? The Campus Martius was purified by Leo X, and the surface, after being divided into streets, was soon covered with houses, churches, and other buildings. The population, at the close of the reign of that pontiff, had already reached sixty thousand. The narrow valley between the Tiber and the Pincian Hill, by which we now enter Rome, was transformed from a vast marsh into the beautiful Piazza del Popolo; and other portions were, by successive pontiffs, greatly ameliorated. The site of the old city, which was not originally favorable to health, both on account of the peculiar condition of the soil and its exposure to the influence of distant sources of miasmal infection, but which had been rendered much less hurtful by drains, the erection of numerous aqueducts, and other works of kindred character, has returned to its pristine state. It has gone to destruction, and is now deserted. The houses and monuments by which it was covered have disappeared; the greater number of the aqueducts have been destroyed, with the effect of allowing the free escape of the water and the formation of marshes and pools; the drains have been choked up; and the whole surface presents a mass of ruins and rubbish."

The applicability of all that has just been stated, in a remedial or hygienic point of view, to the present condition of things in California, is too apparent to require any further comment at our hands. While urging, therefore, systematic and thrifty culture of the soil, with proper ditching and draining, as well as a careful handling of all products, and a general planting of trees in all parts of the State, especially on the sides of the irrigation canals and around the reservoirs, I wish to call special attention to a particular tree, which, it would seem, is well calculated to counteract and neutralize the evil effects which it is apprehended will result from the system of irrigation now adopted. I allude to

THE EUCALYPTUS GLOBULUS, OR BLUE-GUM TREE, OF TASMANIA.

Although the properties of this tree, in regard to the prevention of malarious disease, have in all probability been exaggerated, still there is strong evidence that it does exert an advantageous sanitary influence. As introductory to what I have been able to gather from reliable sources on the subject, I will first quote from a lecture recently delivered by Professor Bentley, before the Royal Botanic Society of England:

"The first and most important influence which this tree exerts, and that which has brought it more especially into notice, is its power of destroying the malarious agency which is supposed to cause fever in marshy districts; from which circumstance it has been called the 'fever-destroying tree.' It is in this respect commonly regarded as being serviceable in two ways: first, by the far-spreading roots of this gigantic tree acting like a sponge, as it were, and thus pumping up water and draining the ground; and, secondly, by emitting odorous antiseptic emanations from its leaves. Probably the influence of the latter is not small; although I am by no means of the opinion entertained by some writers, that these emanations are without effect, I do not certainly believe, as has been recently stated, that the branches of a solitary eucalyptus tree can have had any effect in neutralizing the malarious influence of a district previously constantly infected by fever;

but I do think that the foliage of groves of eucalyptus trees, by diffusing an agreeable, aromatic, camphoraceous, stimulating odor in the surrounding air, does have an appreciable influence in neutralizing marshy miasmas, and thus improving the healthiness of the district.

"But whatever be the cause or causes which render a marshy district thus comparatively healthy to what it was before the introduction of the eucalyptus trees into the neighborhood, the fact is unquestionable, and is now testified to in various parts of the world. Thus, at the Cape, in a very few years, the cultivation of the eucalyptus has completely changed the climatic condition of the unhealthy parts of that colony; and in Algeria, where it has been tried on a large scale in a district previously noted for its pestilential air and consequent prevalence of fever, not a single case now occurs, although the trees are not more than nine feet high; and in the neighborhood of Constantia it is also stated that at another noted fever spot, covered with marsh water both in Winter and Summer, in five years the whole district was dried up by fourteen thousand of these trees, and the inhabitants now enjoy excellent health. In Cuba, again, marsh diseases are fast disappearing from the unhealthy districts where this tree has been introduced. In the Department of the Var it is also said that a station house, situated at one end of a railway viaduct, so pestilential that the officials could not be kept there longer than a year, is now as healthy as any other place on the line, in consequence of the planting of a few eucalyptus trees. Numerous other instances might be cited to the same effect as having occurred in France, Spain, Italy, Germany, and other parts of the world; and we cannot doubt, therefore, that although the effects have been to some extent probably exaggerated, the statements are substantially correct, and that this tree does possess a most beneficial effect in neutralizing and improving the malarious influence of marshy districts.

"The timber of many species of eucalyptus is remarkable for its solidity, hardness, and durability, and for its power of resisting the attacks of insects and the teredo, as also the influence of moisture. Baron von Muller found that the ashes of these trees 'contained a larger proportion of potash than the elm or maple, which are the trees most esteemed for that purpose in America. The yield from the latter trees is estimated at ten per cent of the ashes, while that from the eucalyptus is twenty-one per cent.' The barks of many species are also used extensively for tanning. A number of species also exude a very astringent substance, which, from its resemblance to the ordinary medicinal kino both in appearance and properties, is commonly designated as eucalyptus or Botany Bay kino. It is employed for the same medicinal purposes as our officinal kino, and also for tanning and dyeing. Another substance, called eucalyptus or Australian manna, is also yielded by several species. It occurs in small, rounded, opaque, whitish masses, with an agreeable, sweet taste. It has a similar action to the ordinary manna, and contains somewhat similar constituents. Another important product of the eucalypti is the essential oil. This oil is stored up in the pellucid glands contained in the leaves, and readily observed when these are held up to the light, by the semi transparent appearance they then exhibit. The oil chiefly consists of a substance called by its discoverer, Cloez, *eucalyptol*, a liquid body, in chemical characters, resembling camphor. From the quantity of oil contained in the leaves, they yield, when burned, a very large proportion of gas; and it is said that one of the towns in the gold regions was for a long time lighted by gas extracted from this source.

"The febrifugal properties of the bark and leaves of this plant have been testified to by many practitioners. Probably some of the exaggerated statements that have been made in reference to the efficacy of eucalyptus bark and leaves in fevers have arisen under the mistaken idea that the bark contained an alkaloid resembling, if not identical with, quinine, the well known alkaloid of cinchona barks. But Broughton, the Government chemist of Ootacamund, upon careful examination of the bark and leaves, states that neither quinine nor the other alkaloids of cinchona bark exist in the plant in any proportion. What properties the plant possesses would appear, therefore, so far as known at present, to be due essentially to the presence of eucalyptol, already noticed as the principal constituent of eucalyptus-oil. From the testimony of numerous medical practitioners in various parts of the world where the plant has been introduced, and from its popular reputation in fevers in Australia and other countries, we can scarcely doubt that it does possess antiperiodic properties, although these are far less important than those of cinchona bark.

"When, therefore, we regard the beauty of the different eucalypti, and the proved influence of *E. globulus* in improving the pestilential character of marshy districts, the genus must be regarded as one of the most important to man in the vegetable kingdom."

Turning now to the *Comptes Rendus* of October sixth, eighteen hundred and seventy-two, we find a note presented to the French Academy of Sciences by M. Gimbert, in which the writer says: "A tree [like the eucalyptus] springing up with incredible rapidity, capable of absorbing from the soil ten times its weight of water in twenty-four hours, and giving to the atmosphere antiseptic camphorated emanations, should play a very important part in improving the health of malarious districts." The writer furnishes a few of the numerous results, which are interesting.

The English were the first to experiment in their sanitary plantations in Cape Colony, where they were eminently successful. Two or three years were found sufficient to change the climatic conditions and the aspect of the malarious district of their possessions

Some years ago the Algerians took occasion to spread the eucalyptus throughout the French possessions in Africa, and the following are some of the results obtained as communicated by M. Trottier:

"About twenty miles from Alger, at Pondouk," he says, "I owned a property situated near the River Hamyze, the emanations from which produced intermittent fever among the farmers and their servants every year. In the Spring of eighteen hundred and sixty-seven, I planted upon this farm thirteen thousand plants of the *eucalyptus globulus*. In July of that year, the season in which the fevers appear, the farmers were completely free from them. In the meantime the trees had scarcely attained a height of more than eight or ten feet. Since that time the settled population has been entirely free from fevers."

Fourteen thousand eucalyptus trees were planted upon the farm of Ben Machydlin, in the vicinity of Constantine. It has for several years past been noted for its insalubrity, being surrounded with marshes throughout the entire year. The trouble entirely disappeared, and the soil became perfectly dry in five years. The atmosphere is constantly

charged with aromatic vapors, the farmers are no longer troubled with disease, and their children are bright with health and vigor.

The operations of the manufactory of Gué in Constantine were rendered wholly impracticable during the Summer, on account of the pestilential emanations from the marshes with which it was surrounded. M. Saulier conceived and put into practice the idea of planting a large number of eucalyptus trees in these marshes, and in three years about twelve and a half acres of the marshy soil were converted into a magnificent park. The water completely disappeared, and the health of the workmen has since been in good condition.

In consequence of the large grove of *eucalyptus globulus* on the farm of Maison-Carrée, which is situated in a district in which the inhabitants formerly succumbed to the malaria, similar hygienic revolutions have taken place.

It is stated by land owners in Cuba that there also the paludal and telluric diseases have disappeared from the malarial districts where the eucalyptus has been cultivated.

According to Ramel, Australia is very healthy where the eucalyptus flourishes, and unhealthy where the tree is not found.

On the banks of the Var, near the entrance of a railroad bridge, is situated a garrison house, near which earthworks were thrown up to dam the river in order to build the bridge. The malaria arising from it made it necessary to change the guard each year. Two years ago, M. Villard, the engineer in charge of that section of the road, planted forty trees in the vicinity of the building, and since that time this post has been the most healthy in the country.

In the *Archiv der Pharmacie*, November, eighteen hundred and seventy-four, Dr. I. Homeyer has an article of over twenty pages on its leaves, and their ethereal oil. It is illustrated by several wood cuts, and he concludes that the oil consists of two turpentines, and of cymol.

Dr. G. Vulpius, in the same journal, attributes to this ethereal oil the beneficial effects of the eucalyptus on miasmatic localities.

Mr. J. Bosisto, President of the Pharmaceutical Society of Victoria, points out that the eucalyptus probably exerts its influence in this respect: first, physically, by powerful root action in absorbing humidity from the earth; by its being evergreen, and in continuous action; by the abundance of its leaf surface; by its evaporation of water, oil, and acid under a perpetually genial atmosphere; and, chemically, by the power of its volatile oil, and volatile acid, abundantly present in the plant and air, to produce peroxide of hydrogen.

While this paper is going through the press, we gather the following from the "Medical and Surgical Reporter," of Philadelphia, August, eighteen hundred and seventy-five:

"We are not without hope that the eucalyptus will redeem its reputation. Dr. Cosson recently announced that its effect in Algeria has been very marked. Since the growth of plantations of this tree around the Lake of Fezzara, the malaria, which formerly was intense, has almost disappeared.

"The village of Ain Mokra, according to Captain Ney, furnishes an equally striking instance. The station was formerly so unhealthy that it was necessary to change the French garrison every five days, on account of the number of men attacked. Fever has, however, become much more rare since plantations of *eucalyptus globulus* have been made on the shores of the lake, and the sides of the railway, which include, altogether, sixty thousand trees. A writer in the Paris *Temps* mentions a still more singular effect: namely, that parasites (*phylloxera*, etc.) disappear from vines growing near the eucalyptus. The experiment, made during several years, and in several vineyards, has been uniform in its result.

"It is interesting, in connection with these facts, to observe that the leaves of this plant contain an ethereal oil, of which even half-dried leaves contain six per cent, and that this oil, according to Gimbert, is a very powerful antiseptic. It will preserve blood and pus as long as carbolic acid (five months and more), and far longer than oil of turpentine. It prevents also the appearance of fungi or vibrios. These observations have received independent confirmation from Binz, in Germany."

These evidences go far to establish the fact, that the *eucalyptus globulus* has a good effect in preventing the spread of malarial diseases, and that it may serve decidedly practical purposes in this particular. But the most remarkakble accounts from the eucalyptus tree are those that come from nearer home. We find in the Kern County *Courier* an indorsement of the claims of this tree, which we copy, being confident that it will inspire confidence in what we have said on this subject. The editor of the *Courier* derives his information from personal observation, he being the owner of a farm upon which the matter was tested. He states his observations and experiences as follows:

"We speak somewhat positively in regard to the sanative or anti-malarial influence of the eucalyptus. If all, or even part of the evidence we have read on the subject, coming fram sources entitled to the utmost confidence, is true, we are certainly justified in so doing. But we are not accustomed to speak positively, or to say in effect we know, unless we have the evidence of our own observation or personal experience. In regard to the anti-malarial influence of the eucalyptus, we have this conclusive evidence. We have given it what we regard as a reasonably fair test on our own farm. This is cultivated by two families, or companies, of Chinese. One company lives near the north and the other the south end of the premises, about three fourths of a mile apart. The localities both parties inhabit are favorable to the development of malaria. The soil is rich, moist, and teeming with vegetable life, and the free sweep of the prevailing wind is obstructed by the intervention of dense thickets. As might be expected, they have, every year, during the heated term, suffered with malarial fever. Last Winter we determined to test the much vaunted virtues of the eucalyptus. In February we gave to the party at the north end two ounces of the seed, with directions that it should be planted near the house. It germinated finely, and produced several thousands of young plants, but the frost killed most of them. About twelve hundred, however, survived. These, when the heated term commenced, had attained an average height of two feet, and emitted a strong aromatic or camphorous odor, perceptible at a distance of a hundred yards. In due time the party at the south end were visited by their usual mildly-distressing fever, but up to the present time we have looked in vain for the first symptoms to develop in the other. They are all, to their own astonishment, in the most robust health. These trees now average more

than three feet in height, and the atmosphere of the house is strongly impregnated with their odor. We have investigated in vain for other causes to which to attribute the anomalous state of health of the inmates, and can find none but the reputed sanative properties of this tree. We have finely become convinced from the evidence of our own senses that it will do all the current accounts given of it allege, and propose, the coming season, to plant it on all the waste places and corners on our farm we can spare from other purposes. If everybody would do likewise, the great valley of Kern County might soon take rank among the sanitariums of the State, because as yet no disease, except a mild type of malarial fever, has shown itself. Every land owner, be his possessions large or small, should put it in the light of a duty to plant more or less of the eucalypti."

The foregoing testimonials afford some idea of the interest which has taken root in the public mind, with regard to this tree, not only in California, but in many diverse portions of the earth. This interest, it would seem, is almost of as rapid growth as that of the tree itself. The testimony of the medical profession, too, while it is not so extravagantly sanguine as that of the laity, is, nevertheless, generally encouraging. To the separate question devoted to this subject in the circular, viz: "*Do you know of any instance in which the planting of trees, and especially of the eucalyptus, has exercised a modifying influence on malarial or intermittent diseases?*"—the answers from medical men have all been to the effect that the period of observation and experience has been too short to authorize the expression of any positive opinions. The following reports and communications, however, possess much value in this connection:

[Extract from the Annual Report of the Board of Directors of the California Pharmaceutical Society, October 9th, 1872.]

The remedial powers of the *eucalyptus globulus*, a native of Australia, are receiving much praise from various portions of the world.

This tree (for such it is) is the subject of an important memoir by Professor Gubler. It belongs to the natural order *myrtacæ*—the same that furnishes the clove, pimento berry, also the *melaleuca muriari*, which yields cajeput oil. The species of eucalyptus grows often to a gigantic size, some of the genus eclipsing even the famed *sequoias* of our own State. It is impregnated in all portions with a peculiar aromatic substance, most abundant, however, in the leaves and flowers, which yield by distillation about four per cent of a fragrant volatile oil; this is mobile, nearly colorless, and has a camphoraceous odor. (The odor of the leaves very nearly resembles that of cajeput oil.) By fractional distillation it is separated into several constituents, of which the most interesting has been described by M. Cloez under the name of eucalyptol. By collecting the most volatile portion from the oil by distillation—redistillation from caustic potash and chloride of calcium, a product boiling at 175° centigrade, deflecting the ray of polarization to the right, and incapable of congelation, is obtained, having the formula $C_{12}H_{20}O$, which is the substance in question. It is very soluble in alcohol, which solution, when highly diluted, is eminently a perfume. Cooled to zero and subjected to the action of gaseous chlor-hydric acid, absorption of the gas takes place, accompanied with an abundant crystallization; these crystals, however, are not permanent, spontaneous decomposition taking place in a short time with the production of an aqueous solution of chlor-hydric acid, and a peculiar hydro-carbon, boiling at 168° centigrade. The action of anhydrous phosphoric acid upon it yields a liquid hydro-carbon boiling at 165° centigrado, and having a specific gravity of .835 at 12° centigrade (that of eucalyptol being .905 at 8° centigrade), and has the formula $C_{12}H_{18}$, differing from eucalyptol in its loss of the elements of water. It has been named eucalyptene. In the reaction a polymer of eucalyptene is formed, which boils at temperatures not exceeding 300° centigrade. The hydro-carbon formed by the spontaneous decomposition of the crystals, formed from the action of chlor-hydric acid gas upon eucalyptol, is also thought to be eucalyptene. Eucalyptol prevents, in a remarkable degree, the development of cryptograms. Solutions of the organic alkaloids prepared with an aqueous solution of the same, remain clear for a long time after those prepared with pure water are turbid with confervoid growths. It has been stated that the *eucalyptus globulus* contains a peculiar alkaloid, but as neither Cloez or Gubler obtained it, its existence is uncertain. Alkalies give with the aqueous solution a voluminous precipitate but slightly soluble in alcohol, ether, or water; to water and alcohol it imparts a pinkish tinge. The precipitate is readily soluble in dilute acids, which solutions are colorless, or nearly so (being completely decolorized by an excess of acid), and yield upon neutralization, even after treatment with animal charcoal, a deep purplish black precipitate. A hot alcoholic tincture of the leaves upon cooling, lets fall a precipitate which, when purified by solution in boiling alcohol, separates on cooling as a bulky, greenish white precipitate. Neither this, nor the one obtainable by precipitation of the decoction, have been sufficiently studied. Experiments are in progress by a member of this society, and the results will in due time be published.

The leaves of the tree, contrary to expectation, yield no camphor, unless we consider eucalyptol, which indeed appears to be the homologue of ordinary camphor, as such.

This species of eucalyptus is common in and about San Francisco, and is easily cultivated. It is the "Blue Gum" of Victoria and Tasmania, and is known in Spain as the "fever tree," from its efficacy in the treatment of intermittents, having effected cures in which quinine had failed. It is a tree of extraordinarily rapid growth, having been known to increase in height half an inch in twenty-four hours. As a remedial agent it has been exhibited in many forms, viz: the powdered leaves, infusion and decoction, aqueous and alcholic extracts, tincture and in cigarettes.

The tincture has been used with benefit in asthma, by inhalation. Eucalyptol has also been exhibited in pills and capsules, and is recommended in emulsion.

In July, eighteen hundred and seventy-two, Mr. R. E. C. Stearns read before the California Academy of Sciences the following paper:

ON THE ECONOMIC VALUE OF CERTAIN AUSTRALIAN FOREST TREES, AND THEIR CULTIVATION IN CALIFORNIA.

Australian forest trees propagated from the seed, with perhaps a few exceptions, thrive remarkably in California; the climate and soil appear to be nearly or quite as favorable to the growth of these exotics as of the native forest forms.

In many of the principal towns in this State, especially in and around San Francisco, in the neighboring City of Oakland, and adjoining towns on the easterly side of San Francisco Bay, fine specimens of many of the Australian forest species are exceedingly numerous. The most popular of these belonging to the genera *Acacia* and *Eucalyptus*, have been planted for ornamental and shade purposes; the light feathery fern-like foliage of some of the acacias, their gracefulness, beauty and color, combined with rapid growth, present so many advantages as to fairly entitle them to popular esteem. Of the acacias recommended by Dr. Mueller on account of their economic value, (1) I am not aware of any being cultivated in this State for that object. *A. decurrens* (=*A mollissima*), also *A. lophantha*, and some other species, are frequent, and highly prized for ornamental purposes. From twenty to thirty species are enumerated in the catalogues of the principal nurseries.

The many valuable properties of the species mentioned in the footnote, combined with rapidity of growth, would warrant cultivation on an extensive scale, which, if judiciously conducted, would be highly advantageous to the State, and yield a handsome return upon the capital invested. Mueller says that the wood of *A. decurrens*, popularly known as the "Black Wattle or Silver Wattle," can be used for staves, but its chief use would be to afford the first shelter, in treeless localities, for raising forests. Its bark rich in tannin, and its gum not dissimilar to gum arabic, render this tree also important.

A. homalophylla has a "dark brown wood, is much sought for turners' work on account of its solidity and fragrance. Perhaps its most extensive use is in the manufacture of tobacco pipes."

A. melanoxylon "is most valuable for furniture, railway carriages, boat building, casks, billiard tables, pianofortes (for sound-boards and actions), and numerous other purposes. The fine grained wood is cut into veneers. It takes a fine polish, and is considered equal to the best walnut." Under favorable circumstances, it attains "a height of eighty feet, with a stem several feet in diameter." This species requires a deeper and moister soil than *Acacia decurrens* and *Acacia lophantha*, which are especially recommended for their ability to resist drought, and therefore particularly applicable to treeless and sterile areas in the southern part of California, and the adjoining country, where the temperature does not decline below ten degrees.

The peculiar yellow displayed in the China silks and other articles, is obtained from the yellow flowers of a species of acacia, and is of an exceeding permanent character.

The acacias are easily propagated from seed, as I have (with some species) practically tested; and it is not unlikely that the flowers of most of the species, which are yellow, might be equally as valuable for the dyer, as the variety cultivated or used by the Chinese.

Of the Eucalypti, *E. globulus* is very common in California, and easily cultivated; it is the blue gum of Victoria and Tasmania. "This tree is of extremely rapid growth, and attains a height of four hundred feet, furnishing a first-class wood. Shipbuilders get keels of this timber one hundred and twenty feet long; besides this they use it extensively for planking, and many other parts of the ship, and it is considered to be generally superior to American rock elm. A test of strength has been made between some blue gum, English oak, and Indian teak. The blue gum carried fourteen pounds more weight than the oak, and seventeen pounds and four ounces more than teak, upon the square inch. Blue gum wood, besides for ship building, is very extensively used by carpenters for all kinds of outdoor work, also for fence rails, railway sleepers—lasting about nine years—for shafts and spokes of drays, and a variety of other purposes." (1)

(1) A. decurrens, *Willd*, also A. homalophylla, *Cunn*, and A. melanoxylon, R. Br.

Of the rapid growth of this species of eucalyptus and the facility with which it is propagated, most people in California who have had any experience with it are familiar; but as perhaps few persons who have specimens of it growing upon their grounds or in their yards are aware of its value otherwise than for ornamental purposes, I have deemed it a matter of interest as well as of importance to quote from Dr. Mueller's valuable paper. Having propagated the blue gum from the seed and raised many specimens under not particularly favorable circumstances, I can indorse the remarks of the author from whom I have quoted. An instance of rapid growth immediately under my observation, is that of a specimen purchased by me of a nurseryman, which at the time of planting (January fifth, eighteen hundred and seventy-one) measured from the ground level to the extreme tip six and one half feet, and in about eleven months (December eighth, eighteen hundred and seventy-one,) had reached a height of a trifle over fifteen feet; the diameter of the stalk when set out was half an inch, and at the final measurement one and three quarter inches. I am prepared to hear of instances far exceeding my figures, but it should be borne in mind that we had very little rain after this tree was planted, and furthermore that the locality was upon nearly the highest ground in Petaluma. This tree was occasionally but only moderately watered during a part of the time. Other trees of this species planted at the same time, also made a remarkable growth; specimens raised by me from the seed, whose growth I have noted, show a gain of ten and a half inches in twenty-one days, or half an inch per diem.

The development of the lateral branches is as surprising as its perpendicular growth.

George C. Potter, Esq., of Oakland, informs me that specimens upon his grounds nine years old, show a diameter of twelve inches.

Of a large plantation of eucalyptus of the blue and red species made a few years ago by Mr. J. T. Stratton, (2) of Alameda, I hear indirectly that the trees have done well. I hope at a future meeting to be able to learn from Mr. Stratton, and inform the Academy more definitely of the success thus far, and prospects of this highly commendable and important enterprise. (3)

The many valuable properties of the eucalyptus attracted the attention of the French Government several years ago. A specimen in the Jardin d'Acclimation, at Algiers, excited the admiration of the Emperor while on a visit to that place, and upon measuring the tree it was found, according to the Paris *Moniteur*, to have made "a height of thirty feet and a diameter of six inches in two years." Since that time it has been

(1) Vide "The Principal Timber Trees Readily Eligible for Victorian Industrial Culture, etc., by Ferd. Von Mueller."

(2) Report of the Commissioner of Agriculture, 1870, p. 232.

(3) I do not refer to other forest plantations made in California, by Mr. Aiken or Mr. Edwards, and which I sincerely wish may be successful, for the reason that in this paper the chief object has been to call public attention to certain Australian forms.

extensively cultivated in Algiers, and of late it has been stated that it "is making rapid progress in the south of France, Spain, and Corsica, especially on account of its alleged virtues as a remedy for fever. It furnishes a peculiar extractive matter, or alkaloid, called eucalyptine, said by some to be as excellent a remedy against fever as quinine.

In Spain its efficacy in cases of intermittent and marsh fevers has gained for it the name of "fever tree." It is a powerful tonic and diffusible stimulant, performs remarkable cures in cases of chronic catarrh and dyspepsia, is an excellent antiseptic application for wounds, and tans the skins of dead animals, giving the fragrance of Russia leather. The tree prefers a marshy soil, in which it grows to a great height very rapidly. It dries the earth under it by evaporation from its leaves, and shelters it from the sun, thus preventing the generation of marsh miasm" (1)

Of the medicinal properties of *Eucalyptus globulus* we have additional testimony in a recent number of the Practitioner, (2) where Dr. M. C. Maclean relates the results of his experiments on patients in the hospital wards at Netley, England. He says, in connection with certain cases of chest aneurism and cardiac asthma: "With the exception, perhaps, of the subcutaneous injection of morphia, I know no remedy so efficacious in allaying pain, restoring dyspnœa, calming irritation, and procuring sleep in such cases, as to be compared to *Eucalyptus globulus*." He also refers to the use in Germany of a tincture made of the leaf, which "has been used successfully in ℥ ij doses in the treatment of intermittent fevers." It appears that it is not only used medicinally in form of a tincture, but also that cigars are made from the leaves, and its palliative influence obtained by smoking.

"German physicians, as appears from medical journals, have found a tincture of the leaves of the *Eucalyptus globulus*, or Australian gum tree, to be a remedy for intermittent fever. Dr. Lorimer gave it to fifty-three patients, of whom forty-three were completely cured. In five others there was a relapse, owing to a failure in the supply of the tincture. In eleven of the cases quinine had been used without effect, and nine of these were cured by the eucalyptus." (3)

Other species of the eucalypti, of great value and well worthy of consideration, are recommended by Dr. Mueller.

E. amygdalina, Labill, which is sometimes met with four hundred feet in height; one specimen in the Dandenong ranges measured four hundred and eighty feet, (4) surpassing in altitude the gigantic *sequoias* of our own State. The wood of this species is said to be well adapted for "shingles, rails, house building, for the kelson and planking of ships, and other purposes." In rapidity of growth it equals *E. globulus*, but is not so easily satisfied with any soil.

E. diversicolor, F. v. Mueller, a native of S. W. Australia, sometimes reaching four hundred feet in height, with a proportionate growth of stem. The timber is excellent, and young trees are reported as doing well even "in dry exposed localities in Melbourne." It is regarded by Dr. Mueller as a valuable shade tree for avenues, as it makes a dense growth.

(1) Harper's Magazine, March, 1872; Scientific Record, p. 630.
(2) No. XLI, p. 268, Nov., 1871.
(3) Annual Record of Science and Industry, 1871, p. 586.
(4) Trans. and Pro. of the Royal Society of Victoria, Part I, Vol. VIII, p. ix.

The *Eucalyptus citriodora*, Hooker, a native of Queensland, "combines, with the ordinary qualities of many eucalypts, the advantage of yielding from its leaves a rather large supply of volatile oil, of excellent lemon-like fragrance."

E. gomphocephala, Candolle, grows to a height of "fifty feet, wood close grained, hard, and not rending."

Eucalyptus marginata, Smith, "the Jarrah or mahogany tree of S. W. Australia, famed for its indestructible wood, which is attacked neither by chelura nor teredo, nor termites, and therefore so much sought for jetties and other structures exposed to seawater, also for underground work, and largely exported for railway sleepers. Vessels built of this timber have been enabled to do away with copperplating. It is very strong, of a close grain, and a slightly oily and resinous nature; it works well, makes a fine finish, and is by shipbuilders here considered superior to either oak, teak, or, indeed, any other wood." The tree does not grow as rapidly as the blue gum in the neighborhood of Melbourne, but Dr. Mueller expresses the opinion that it would make a rapid growth in a more favorable locality.

The *E. rostrata*, Schlecht, the red gum of Victoria, is a very valuable species for the "extraordinary endurance of the wood underground, and for this reason highly valued for fence posts, piles, and railway sleepers; for the latter it will last a dozen years, and if well selected, much longer. It is also extensively used by shipbuilders for mainstem, sternpost, innerpost, deadwood, floor timbers, futtocks, transoms, knightheads, hawsepieces, cant, stern, quarter, and fashion timber, bottom planks, breasthooks and riders, windlass, bowrails, etc. It should be steamed before it is worked for planking." Next to the Jarrah from W. Australia, this is the best wood for resisting the attacks of seaworms and white ants. This species reaches a hundred feet in height, which is also the height of the next and the last of the eucalypti referred to herein, viz: *E. sideroxylon*, Cunn, which produces a wood of great strength and hardness, and desirable for carpenters, shipbuilders, and wagonmakers, being suitable for wheels, treenails, belaying pins, and is considered the strongest wood in the colony; also valuable for railway sleepers, underground work in mines, etc.

The wood of the gums is "so soft at first as to render the felling, splitting, and sawing up the tree, when green, a very easy process, but when thoroughly dry becoming as hard as oak." (1)

When we consider the fact of the great number of farms in California that are nearly or wholly destitute of wood, and the great and continuous expense entailed by our system of fencing, the importance to the farmer of dedicating a portion of his land to the cultivation of forest trees, from which he can obtain fuel and fencing materials, is too palpable to admit of debate. The comparatively small expense and labor with which the cultivation of a few acres for the purposes I have named is attended, its absolute feasibility and practicability, with the beneficial results that would flow therefrom, should commend itself at once to every farmer, as a few acres of timber land for economic purposes would add much more than the cost to the cash value of the farm. The boundaries of a farm should be marked by a row or rows of trees, thus defining its limits by living monuments, and greatly adding to its beauty. From these rows, as the trees advance in growth and age, some wood

(1) Baird's Dict. Nat. Hist., p. 235.

could be cut, and where the farm is of considerable size, enough in the way of trimmings or prunings to supply the fuel of the house. In the treeless areas of the southern part of the State, the varieties of acacia above named would prove an important aid in assisting, by their protection, the planting of other species of timber, as they are easily taken care of, and will stand excessive drought. They would also be useful, as is our Monterey cypress (*cupressus macrocarpa*), for belts to break the force of the winds in exposed places, and it is to be hoped that before many years, timber belts for this purpose will be common wherever the coast winds prevail, as a protection to the orchards and vineyards.

We have many native trees well adapted for timber or wind-breaks; and while calling the attention of land owners and others to the exotic forms above mentioned, and their special qualities as enumerated in Dr. Mueller's excellent paper, I do not wish to be understood as making an unfavorable comparison as against indigenous species, as for some of the purposes mentioned they will answer equally well.

It must be remembered, however, that our forests are unfortunately deficient in many of the hard woods much used in the arts, and which we are now compelled to import from localities more favored in this respect. The aggregate amount annually sent out of the State for the purchase of this material, could, by proper foresight and enterprise, in a few years, be retained within our own borders, and here expended in the establishing of new industries pertaining to the very material, the manufacture of which in other portions of the Union employs large communities, to whose support we are now contributing.

As in Germany, to anticipate a future need, our own *Sequoia sempervirens*, or redwood tree, is extensively cultivated; so here, by the cultivation of the Australian eucalypti, we can, in a few years, supply a positive want, and reap the advantages above indicated.

Since the reading of the above paper, I have had many questions asked me by persons not present at the meeting of the Academy, and as an answer to said inquiries, and to various propositions, I have added the following:

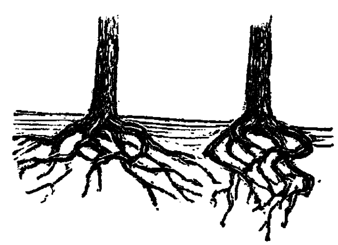
Some objection has been made to the acacias and eucalypts, by persons who have planted them for shade or ornamental purposes in the vicinity of San Francisco, for the reason, as alleged, that they do not withstand the winds. So far as the observations of myself, and others who have investigated the matter, extend, it is really surprising that so few are prostrated. The fault is not with the trees, but the purchaser; as trees of from four to six feet in height are sold at a low price, they are bought by parties who require only a few in preference to smaller trees, as they make a greater immediate show. As most of the growth of the trees, as usually purchased, after having attained a height of six inches, has been made in the pot or box in which they are sold by the dealers, it will readily be perceived that the tap-root, which, in a natural state, descends, is diverted from a perpendicular into a rotary direction, analogous to a spiral spring, and is also crossed and recrossed on itself, with the liability, as it increases in size, to strangle the tree, by one portion of this root making a short turn or twist upon another part of the same, or by being wound about and restricted by the lateral roots. It is therefore apparent that the better policy would be, even where only a few trees are wanted (and this remark applies with equal pertinence to all trees), that, other things being equal, such as comely shape and healthy condition, the younger and smaller trees are really cheaper at

the same price than the larger, and can generally be obtained for much less. For forest culture, the smaller trees are indispensable to success.

Again, it is frequently the case that the lower branches are trimmed off to a mischievous extent, which also is a mistake; for where a tree has sufficient space to grow in, but little trimming is necessary, and it is a false taste which seeks to improve (?) upon nature by depriving a tree of its normal physiognomy and distinctive character by carving it into grotesque or inappropriate shapes; it is simply mutilation, and is certain to result in the premature decay and death of the victim. The flattening of the head by certain aboriginal tribes, and the distorted feet of the fashionable Chinese ladies, are further and pertinent illustrations of analogous hideous violations of natural form.

The annexed letter from Dr. W. P. Gibbons, of Alameda, contains so much practical knowledge in regard, especially, to the cultivation of the eucalyptus, that I here insert it for the benefit of the public, although the author did not write it for publication:

I am sorry to say that I can contribute nothing of my own experience which is calculated to throw light on the medical properties of the *eucalyptus globulus*. Though I have frequently used it, the results are not such as to warrant any general conclusion of its therapeutic value. I am not entirely clear in my own mind as to the species intended to be designated as "blue gum." According to Wools, as well as Mueller, there are three species popularly recognized as "blue gum:" *blue gum, flooded gum, and Cumberland gum*, are names of the *eucalyptus goniocalyx;* a tree of small growth in some localities, and in others attaining two feet diameter in thirty years. It generally attains, however, a height of seventy or eighty feet, and a diameter of seven feet. It is valued for its timber, for building and other purposes. In Western Australia, on the Mittagory Range, is the mountain blue gum *eucalyptus engenioides*, the wood of which is considered inferior to the *goniocalyx*. The *Tasmanian blue gum* is the *eucalyptus globulus*. In its native localities it is subject to the ravages of beetles. This is the species, which is so commonly known (whether correctly known, I am unable to say,) throughout California. * * * As to the cultivation of the tree, the gist of the matter is this: gardeners pot the young plants, and, after they have so grown for a year or more, they send them to market. A potted tree always has distorted and horizontal roots. Hence, if placed in the ground without root-trimming, it will always maintain a spiral and circumscribed growth. Thus we see a root, so distorted, has no chance of sending off side growths and perpendicular growths, which will anchor the tree in soil. A potted tree should always be well trimmed in the roots, so as to give a chance for young, vigorous, and spreading branches. Don't leave long and twisting roots upon them.



Again, the tree should never be trimmed up. The young tree has a different leaf from the old one. For two or three years nothing but nursing leaves grow upon it. These leaves are larger, and present a

much greater respiratory surface than subsequent leaves. They are necessary to give development to the root. As soon as the adult leaves are developed, the side branches, bearing the milk leaves, die off. The tree should never be topped, as this would spoil its beauty, mar its growth, and render it more liable to be blown over during high winds. All the foregoing precautions are advisable to prevent this accident. Calculate the area of foliage exposed to wind, and the resultant direction of force there applied, and you will see the point.

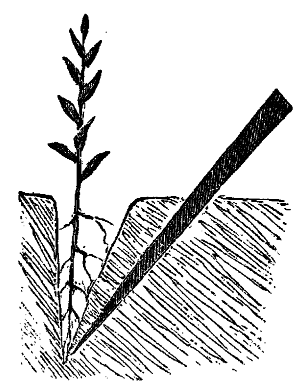
It is as impossible for a healthy tree that has been well root trimmed and planted, to blow over, as it is impossible for a potted tree, headed off and carelessly planted, to stand a storm. By planting them ten feet apart, they will support each other during wind storms. I would recommend the planting of several species. The *E. vinsinalis* is a very graceful tree, yielding a substance called manna. It grows one hundred and eighty feet high and eight feet in diameter; the wood is not much esteemed. The *E. colossea* grows four hundred feet high; is more bushy than globulus, and of more rapid growth; the timber is good. The *E. amygdalina* has been known to grow four hundred and eighty feet high. The *E. eugenioides* is of fine growth, one hundred and fifty feet high. By multiplying the number of species planted, we insure some from disease and premature decay.

From the *Rural Press* we gather the following additional information respecting the seeding and planting of this tree, from the same authority above referred to:

Plant your seed immediately, in a box twelve inches deep, containing eight inches of clean, rich loam, by dropping the seeds on the surface, about an inch apart, and covering them with a quarter of an inch of sawdust, or by sifting vegetable mold over them to a like depth. The common method of placing the seed in three or four inches depth of soil, is objectionable, as the roots soon penetrate to the bottom of the box, and are bent off at right angles to the axis of the plant. This distortion prevents the tree from having such a firm hold in the soil, as it otherwise would. Hence so many eucalyptus trees blow over after having a growth of four or five years. Their germination may be facilitated by soaking them for twenty-four hours in a pint of warm water, in which a piece of saltpetre or carbonate of ammonia about the size of a marble, has been dissolved. Place the box in your kitchen, or some other warm locality where sunlight will reach it, cover it with glass or a piece of board, and keep the soil watered every day, sufficient

to give a decidedly moist character thereto; if possible, keep up a temperature of about seventy-five degrees Fahrenheit, during the daytime, until the seeds sprout. When they are half an inch high, remove the covering, and give them sunshine. They will grow more slowly, but the plants will be more hardy and vigorous. When they are four inches high, they should be gradually seasoned to out-door temperature, so that they may be ready to transplant as soon as frosts disappear. You will then have trees from four to six inches high, growing in a depth of soil which will insure straight and vigorous roots.

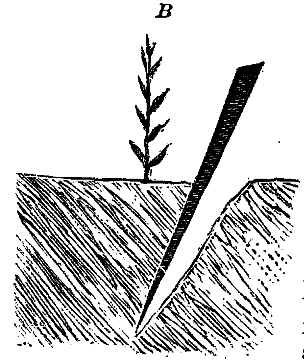
A



I presume, now, that I am talking to a farmer, who has from one hundred to five hundred acres of land; who has been raising cattle, horses, hogs, and sheep, for twelve years past; who has never planted a forest tree on his premises; who has stripped his cañons of the few straggling oaks which once kept up a flowing stream throughout the year; who has spent his money in purchasing fencing for his fields; whose homestead looks as dreary as weather-beaten boards and ash-colored surroundings can make it. I know that there are hundreds of such farmers around, and I wish to show them the money-making aspect of cultivating trees.

You have one hundred acres of ground then. That will be equivalent to a square plot of ten acres to each side, of two thousand and eighty-six feet; so that the outside of your farm will measure eight thousand three hundred and forty-four feet round. Subsoil a strip twenty-six feet wide round your land; this will take up five acres. Through this strip open four furrows six feet apart, and run the plow through each several times till the soil is loosened deep and finely pulverized. The ground is now prepared for planting.

B



Take a piece of thick twine or bale rope some two hundred feet long, untwist and tie through the strands short pieces of rag four feet apart; stretch the line tightly along the center of one of the furrows, and with a dibble make a hole six inches deep and an inch and a half in diameter opposite each mark on the line. Knock off one side of your box containing the plants, and with a trowel or strong knife carefully detach each tree from the soil, disturbing the soil about their roots as little as possible. Then take the tree between the thumb and finger of the left hand, pass its root into a hole to its natural depth, and with a trowel or piece of flat, hard wood pointed at the end, press the dirt around the root, and level the soil about it. In short, plant them just as you would cabbages or tomato plants; but mark this point, be *sure* that the roots are vertical. See this representation—figure A. The tree is in the hole with the stick ready to close in the soil about the root; figure B, the tree as planted with the stick ready to withdraw from the soil. You will thus have four rows of trees round your farm, four feet apart in the row,

and the rows six feet distant; each row will contain two thousand and eighty-six trees, making an aggregate of eight thousand three hundred and forty-four trees, occupying five acres of your ground. Two men can plant three thousand trees in a day in this manner. They will require no stakes. They must be dressed by the cultivator three times during the first year, and they must receive one plowing and three dressings each succeeding year, for four years.

The following table will give the dimensions of the trees at five years old, and at every succeeding year, till they are thirteen years old:

Age, years.	Diameter, inches.	Height, feet.	Wood in cubic feet.
5	9	40	5.75
6	10	45	8
7	11	50	11.5
8	12	55	14.33
9	13	60	18.40
10	14	65	23
11	15	70	28
12	16	75	34.75
13	17	80	42

On the sixth year, take out every other tree of first row; seventh year, second row; eighth year, third row; ninth year, fourth row. The amount of cord wood obtained each year will be forty-seven, fifty-seven, ninety-three, and one hundred and sixteen, making a total of three hundred and twenty-three cords. You will now have left four thousand one hundred and seventy-two trees, and the trees will be eight feet apart in the row. On the tenth, eleventh, twelfth, and thirteenth year take out every other tree, and the amount of cord wood obtained will be seventy-five, ninety-three, one hundred and fourteen, and one hundred and forty, making four hundred and twenty-two cords. Making an aggregate of seven hundred and forty-five cords of wood obtained, and a balance of two thousand and eighty-six trees, which will contain six hundred and eighty-four cords. Now sum up the whole operation. Total quantity of wood realized at the end of thirteen years, one thousand four hundred and twenty nine cords, at a cost of:

Seed	$5 00
Preparing five acres of ground	15 00
Six days' labor planting	12 00
Subsequent cultivation	60 00
Total cost	$92 00

These estimates are within bounds. On dry hillsides, the growth will not be so rapid, and if fifty per cent be taken from the foregoing results, there will still be left a wide margin for profit. On the other hand, on larger farms, a much greater number of trees may be thus cultivated. The outside capacity of one hundred and sixty acres will be fourteen thousand trees, yielding at the end of thirteen years, two thousand four hundred cords of wood. Any other kinds of forest trees will prove remunerative if cultivated, but on account of the rapid growth of the

eucalyptus and the density and durability of its wood, it commends itself over other kinds for immediate profits. But some farmers must bear in mind one cardinal fact: that while Providence furnishes the material and conditions for the healthy growth and development of trees, it does not engage in the cultivation of the soil.

CONSUMPTION.

But the plantation of trees is not the only process for arresting or mitigating the prevalence of fevers and other diseases resulting from the toxic effects of malaria. I say other diseases, because the action of malaria is by no means confined to intermitting, or typhoid, or other acute zymotic affections. The effect may not be to produce actual disease, but day by day it insidiously degenerates the vital force, and not infrequently superinduces that depraved condition of the body which is marked by tubercular deposit in the lungs. The most striking evidence in this matter is furnished in Holland, as is shown by the reports of Dutch and Belgian physicians, as well as by the latest observations in Algiers. According to the high authority of Dr. H. Von Ziemssen, tuberculosis, and the phthisis, resulting from cheesy pneumonia, are very frequent diseases in the fever districts of Holland and Amsterdam, and especially in the "polders" of Holland—those portions of land reclaimed from the sea by the building of dykes. These pulmonary affections are often associated with repeated attacks of intermittent fever, followed by the malarial cachexia.

In the last Biennial Report of the State Board of Health, the mortality by consumption is shown to be from two and one half to twenty per cent of the deaths from all other causes. A further examination shows the distribution of these deaths to be very unequal in the various towns reported, the mortality by consumption in some of them being greatly in excess of that found in others of equal size, and of equally stationary population, representing all ages. Doubtless a large proportion of these deaths is attributable to the number of the phthisical, who seek too late the benign influence of our climate, and thus add to the sum of mortality, by consumption, in the locality where they die. This is particularly the case in Santa Barbara, where consumption was comparatively unknown before the town became the sanitarium it now is. But making every allowance for the fluctuating character of our population, and the hopeless condition of many of the immigrants, the mortality by consumption is still greatly in excess of what we might expect it should be, especially in such localities as the region of the Russian River, Napa, Sonoma, and Petaluma Valleys, and that portion of the Sacramento Valley embraced in Yolo and Solano Counties, the southern part of the San Francisco peninsula, the San José and San Joaquin Valleys, and the coast region between Los Angeles and Santa Cruz, where the rate of mortality by consumption is between fourteen to twenty per cent. From a careful comparison of statistics furnished by physicians in all parts of Massachusetts, Dr. Bowditch has inferred the influence of a *damp location* in inducing, or at least promoting, consumption, and the influence of the same cause in giving rise to rheumatism, sore throat, and other inflammatory affections, is well known by all physicians. Our statistics, as far as they go, are confirmatory of the same conclusions.

Most of our towns have been located accidentally to meet the exigencies of trade, and without a thought as to sanatory advan-

tages. So also with our farming settlements. I have sought information from medical correspondents, chiefly by propounding queries relating to the causes of malaria, and find that the considerations, which determined their site, were convenient access to water, rivers, or roads. Whether the soil and surroundings are fit for a healthful residence is a secondary question. High situations are apt to be avoided, because too windy, and low ground preferred because more accessible, and because springs are more common here, and wells more easily dug. Hence farm settlements are often placed in the immediate vicinity of wet meadow land, scarcely above the water-line; or else on the springy soil which is frequently found at the foot of a hill; or else on the "hard-pan," which, at all levels, crops out here and there between strata of gravel, and which, by holding the surface water, is always wet and cold. It is not more difficult, therefore, to discover the causes of consumption in such surroundings than it is to explain the relative prevalence of the same disease in certain localities in the coast region already mentioned, where, owing to the damp and chilling oceanic winds during Summer, as well as Winter, the maximum mortality is found. Common sense, therefore, naturally suggests *drainage of soil and sewerage*, which is the other means above referred to as best calculated for arresting, not only malarial diseases, but also consumption. And it is a singular confirmation of the value and importance of this simple hygienic measure, resulting from observation and comparison exclusively, and without any preconceived ideas, that the English physicians, while entirely ignorant of the discoveries of Dr. Bowditch, arrived at the same conclusions. In eighteen hundred and sixty-five–sixty-six, inquiries were made in England, under Government authority, into the effect of certain sanitary works and regulations designed to promote the public health. In pursuance of this inquiry, twenty-four towns were selected in which improved drainage had been established. It appeared, that while the death-rate had greatly diminished, it was most strikingly evident in the smaller number of deaths from consumption. In commenting upon this fact, the chief medical officer reports, that "the novel and most important conclusion suggests itself, that the drying of soil, which has, in most cases, accompanied the laying of main sewers in the improved towns, has led to the diminution, more or less considerable, of phthisis."

As I have proceeded in writing this paper, the subject has so grown upon my hands that I have barely alluded to many important points, such as drainage of soil and sewerage, which will receive due attention in the next biennial report of the State Board of Health. Thanking you for your patient attention I must now close, merely expressing the hope that what I have said will be seriously considered.

[As no criticism adverse to the views advanced has been received since the reading of the above paper, it is fairly presumable that it is in general accordance with the opinions entertained by the medical gentlemen to whom it was presented for indorsement.]—Secretary State Board of Health.

ON FOREST CULTURE AS A PROPHYLACTIC TO MIASMATIC DISEASES.

By W. P. GIBBONS, M. D.

[Read before the Alameda Medical Association, May 3d, 1875.]

It has not been proved, though asserted until belief is established, that the aroma of the eucalyptus is effective in preventing the incubation of intermittents. The exceeding rapid growth of the tree is dependent on the quantity of water which is accessible to its roots. The proverbially unhealthy atmosphere of swamp land is due to stagnant water. Where currents are established by drainage or by excess of water, the cause of malarious fevers, if not entirely removed, is materially abated; it would be removed if the drainage were complete. Let us look at the results which naturally follow the planting and cultivation of some kinds of forest trees. In eight years the eucalyptus will attain a diameter of eighteen inches and a height of fifty feet. Experiments which I have made determine these facts: A branch of this tree which contains one hundred and five square inches of leaf-surface, will absorb 3 25 ounces of water in eighteen hours. The entire tree will furnish an area of three hundred and ten thousand five hundred square inches of leaf-surface, and the amount of water daily absorbed by the roots would equal six hundred and nine pounds, or seventy-six gallons. Given a stagnant swamp of two hundred acres, each acre having two hundred trees, and the amount of water daily absorbed by the roots would be three million and forty thousand gallons, or four hundred and five thousand three hundred and thirty-three cubic feet. This would be equal to a constant stream, running at the rate of three miles per hour, of two feet wide and six inches deep.

This question has a practical import, as applied to two projects which are now being discussed, and to the results on public health which would follow the adoption of either; the irrigation of the San Joaquin Valley, and the introduction of the water of Lake Tulare into San Francisco for economical purposes. The direct effect of irrigating the low lands of the valley would be the formation of a larger area within which malarial fever would prevail; for it is well known that there are lands along the San Joaquin, the Merced, and some of their tributaries, dry during the Summer months, but which, on being plowed, liberate the subtle poison which engenders disease. Farmers, without exception, have experienced this, in having every member of the family prostrated with intermittents. Physicians are cognizant of many places where the upturning of dry meadow soil, for agricultural purposes, has been followed by malarial fever. During the construction of the Central Pacific Railroad along the San Joaquin Valley, nearly every laborer became a victim of the same disease. The great district in California which is subject to malarial fevers includes large portions of the Sacramento, the San Joaquin, and the Tulare Valleys, extending from the

sixth standard north from Mount Diablo base to the eighth standard south, covering an area of three hundred and seventy-five miles in length, with a width varying from two to twenty-five miles. Much of this low land is known as tule swamp, from its being covered with *Scirpus lacustris* L., which grows in places from eight to twelve feet high. Other portions have a dense undergrowth of willow, which disappears in the neighborhood of the tules, but which reasserts its claim to the watery soil in places along the whole course of the valley. Outside the willows and the swamp, is a sandy alluvium, which comprises the arable portion of the soil.

This immense field of swamp and overflowed land, covering an area of over six thousand square miles, has comparatively little population outside of Sacramento, Stockton, Marysville, and other cities, which are feeders to the agricultural and mining population. Hence, it is difficult to estimate the area which may properly be regarded as malarial.

Will extensive irrigation change the climatal condition of a district of country? The question has been practically answered in the mining districts of California and elsewhere. Before the formation of ditches and the damming of the upper waters of rivers which form tributaries of the Sacramento and San Joaquin, the surface moisture of land among the mountain foothills was generally evaporated by the middle of May or the first of June. At this time clouds ceased to form in the upper air, and by day and night the unbroken clearness of the sky during the Summer solstice permitted the full intensity of solar heat to impinge on the denuded soil. The heat thus acquired during the day was seldom radiated with sufficient rapidity in the night to bring the temperature of the air within range of the dew point. In fact, during the latter part of Summer, the air was almost absolutely dry. The absence of dew thus became a marked feature of the interior climate.

After the headwaters of the rivers had been dammed, and ditches to the extent of seven thousand miles constructed, which spread water during most of the Summer through thousands of smaller channels, the air became so charged with vapor that deposits of dew became the rule instead of the exception. No other change was manifest except a slight reduction of temperature as a sequence of evaporation. Beyond the results thus foreshadowed in mining operations, and the certainty of securing fair crops, there is nothing to be urged in favor of extensive irrigation as compensatory to giving greater activity and diffusion to malarial poisons.

The matter of cultivating forests becomes then a question of almost vital importance to every settler within the precincts of this low land. It is not a doubtful experiment as a hygienic measure. The medical faculty need not be reminded of the conditions which increase the virulence of, or which destroy malarial poisons. Observation has established as facts: that excess of water in soil, by producing currents which carry off the poison or dilute it to the extent of rendering it obnoxious, prevents the formation of miasma; and that a lack of water in soil, by abstracting a necessary factor to vegetable decomposition, also prevents the development of disease. It is between these extremes that the forces operate which render active the toxic properties of marsh miasm. There must be added, however, a temperature ranging upward from sixty degrees Fahrenheit, and prolonged for weeks or months, before all the conditions which are necessary to produce vegetable decomposition and miasm are fairly established.

What then is the modus operandi by which forests purify the atmosphere and prevent the formation of marsh miasm? It has been stated that six thousand square miles of the great valley are included in overflowed lands, and this amount may be reclaimed. (1) Let us so enlarge the experiment detailed on a previous page as to make a belt of eucalyptus trees two miles wide, and extend it three hundred and seventy-five miles, or the entire length of the valley. Nature works by small accretions, but operates on a large scale. She would of herself execute all the work which is here laid out, were she allowed a little time. But the aggressive spirit of Yankeeism must accomplish tremendous results within a few years of business life. It cannot tolerate the idea of using up a few centuries out of the storehouse of eternity, in order that a piece of swamp land or a section of arid debris should be converted into a spot befitting fifty bushels of wheat to the acre. Fortunately for science, this spirit was not "peeking" round in the palæozoic age, as all transitions between the awkward Silurian and the post-tertiary eras would have been totally ignored.

A forest of the before-named magnitude would contain ninety-six million trees, and during every twenty-four hours there would be exhaled seven billion two hundred and ninety-six million gallons, or nine hundred and eighty million cubic feet of water. This would be sufficient to fill a ditch fifty feet wide, nine and five tenths feet deep, and three hundred and seventy-five miles long, which, flowing from each extremity of the valley to its outlet in San Pablo Bay at the rate of three miles per hour, would require two days to empty itself. The water taken up and exhaled by such a mass of trees would be equivalent to a constant stream of this volume.

This estimate represents the capability of daily absorption. The quantity of water which would actually be thus taken from the soil may fall far short of this amount, for the ground, not being always saturated, would afford but a limited supply to the roots. The range in quantity between fact and theory will not affect the argument, inasmuch as there is always maintained, in living organizations, a definite, yet varying degree of activity between the functions of the system and its consumption of food.

But absorption of water, and its subsequent exhalation, do not constitute the process of nutrition and growth in the vegetable world. The water of the soil not merely holds in solution all the solid mineral matter which goes to make up the substance of the tree, but gaseous elements, either in a simple form, as of atmospheric air; or combined, as in carbonic acid, sulphureted hydrogen, and other mephitic gases. Whatever there may be held in solution is, in a general sense, absorbed by the roots and conveyed, with little or no change, to the leaves, which form the laboratory of the vegetable world. Carbon, hydrogen, lime, potassa, soda, and other substances, are here subjected to changes, by the agency of solar light and heat, which adapt them to the composition and the structure of the tree. This chemical activity is rapid in many growths, especially in the eucalyptus. The strong aroma of its gum is diffused to a distance of thirty or forty feet. The hydrogen, which forms one of its elementary constituents, is derived from the decomposition of water which the tree takes from the soil. The entire

(1) Land Office Report, 1868.

process of vegetable life constantly carried on in effecting the assimilation of food, not only returns to the atmosphere oxygen, as a product of the decomposition of water and carbonic acid, but restores the purity of all other substances that are exhaled either in a simple or compound form. Thus, in whatever shape marsh miasm may exist—whether held in solution by water and diffused in the vapor of night, or retained in the soil and liberated by the presence of water—it is certain to be destroyed by an adequate development of forest growth. This is so fully recognized in medical literature as to render exemplifications unnecessary.

As another sequence of the activity of vegetable growth, the cooling of the atmosphere is prominent. This reduction of temperature is mainly due to exhalation of water from the leaves. This function is most active during the day; for the more rapid the evaporation the cooler does the air become; consequently, the greatest difference of temperature between the open air and the shade of a tree is from noon until three o'clock P. M. This range, being affected by local causes, cannot be precisely and uniformly indicated, except by actual experiment. Where the thermometer stands in the shade at 85° Fahrenheit, it will be at 100° in the sunlit air, protected from direct solar rays; at the same time the surface soil will indicate 115°. This is the breathing temperature prevalent for parts of several months along the great valley of which we have spoken. At times 130° or 140° is indicated by the thermometer. It is very common for the night temperature to stand at 80° or upward. At such times the incubation of disease is active.

Unless the conditions be peculiar, a maximum temperature of 80° through the day will be followed by a minimum temperature below 60° during the night. Along seashore counties the thermal range is not so great, and in valleys protected from ocean breezes the radiant heat during night arrests the cooling process from inflowing air.

Let us see what disposition would be made of the vast amount of liquid daily absorbed and discharged into the atmosphere. At 212° a cubic foot of water will be converted into one thousand six hundred and ninety-six cubic feet of vapor. At 60°, with the barometer at thirty inches, each cubic foot of air will contain 6.22 grains of vapor. The nine hundred and eighty million cubic feet of water will saturate a belt of atmosphere three hundred and seventy-five miles long, ten miles wide, and one thousand two hundred feet in thickness, which would be resting over the valley for the greater portion of every twenty-four hours. But would the swamp land yield this quantity of water every day? Estimating the average rainfall at eighteen inches, and excluding the inflowing water from mountain streams, it would require over eight hundred days for the forest to absorb all the moisture that the valley received during the Winter months. If this process commenced with the active growth of vegetation in February, and were to continue but one hundred and twenty days, all the requirements of growing crops would be met, without appropriating over one sixth of the amount which fell upon the land. Moreover, there would be a compensating action constantly going on, in consequence of the vapor, rendered to the atmosphere, being partially returned to the soil by condensation.

The arid nature of parts of the San Joaquin Valley is not referable to high temperature and evaporation alone. In the middle of the plains, east of Stockton, excavation shows a succession of strata formed of washed bowlders and coarse gravel, more than seventy feet in depth,

before a retentive water-bearing bed is reached. Other parts of the valley show a similar formation, and evidence tends to the conclusion that the inland sea which once covered this area was obliterated by debris brought down from the mountains on either side. In fact, the process of denudation is still active, as may be seen along the entire course of the range. This deposit, being coarse and loosely packed, cannot retain the water which falls upon the surface. Such is the character of more than two million acres of this arid land.

It is not possible to define the distance which the roots of trees will travel, under favorable circumstances, in quest of water. Some years ago, in the process of grading Clay street, San Francisco, excavation was made through a sand-bank to the depth of thirty feet. A small scrub-oak, four inches in diameter, was growing on the crest of the hill, on the line of the cut. I traced its main root thirty feet in a vertical line, and at that depth it was still half an inch in diameter. East of Alameda there is a hillside cut, which gave origin some years ago to a small landslide, exposing the root of an oak tree. When I observed this for the first time, there was a small root-fibre, which looked like a piece of half-inch rope, stretched horizontally for a distance of nearly forty feet, without any apparent diminution in thickness. At the present time it is over three inches in diameter, and its distal extremity is doubtless over one hundred feet from the trunk. Thus it is that the terminal roots of trees, through which absorption takes place, will follow, horizontally or downward, the receding line of moisture to an extent that is determined by the texture of the soil. Roots, like branches, are always throwing out side-buds, which sometimes increase in number to a marvelous extent. There is a well in Alameda four feet in diameter, which was almost filled with the roots of a sycamore tree that grew within a rod of it. There is another well in the yard of the Congregational Church, in Oakland, from which was taken a solid mat of roots, none larger than a thick knitting-needle; the whole about three feet in diameter and two feet in thickness. These cases, among many, are sufficient to show the extent of root development in the presence of a copious supply of water. They also show the rapidity with which organic matter can be supplied to the soil from this source; and, furthermore, the modus operandi whereby a loose, coarse deposit of purely mineral matter has its interstitial spaces supplied with vegetable mold, and is thus converted into productive soil.

These secondary results of forest-planting land, while being carried on far beneath the surface, are supplemented by processes of trunk growth. Everybody is familiar with the fact that under an old tree there is always from six to twelve inches of vegetable mold, derived from the decomposition of leaves and bark which are annually shed. The weight of dried matter thus furnished by a tree of the size indicated on a preceding page, will not fall short of two hundred pounds. A considerable portion of this is composed of organic matter, some of which may be resolved by subsequent oxidation. The balance constitutes the potassa, lime, silex, and other minerals, which, held in solution by the water of the soil, have been taken up by the sap, conveyed to the leaves, metamorphosed into the solid material of the tree, and partly returned to the earth through the leaves and bark. The results of this process, on a large scale, and during consecutive years, may be seen in any forest-growth which originated on a bed of gravel. Fine mold fills the interstices between washed or angular pebbles, furnishing sustenance to a dense undergrowth of shrubs and succulent plants. Time was

when such localities were as unpromising to vegetation as any which now compose our Californian valleys.

It may be said that this theory proves too much; that if trees take up so much water from the soil, the surface ground must necessarily be desiccated, and thus rendered unfit for cereal crops. This does not follow. While it is admitted that during the growing season the soil beneath forest trees may contain a proportion of water smaller than that without their range, it is also true that a large portion of the San Joaquin Valley, having a known depth of seventy or one hundred feet, being the product of denudation and not retaining the rainfall of Winter near the surface, is capable of sustaining a sparse vegetation only so long as frequent rains keep the substratum in a moist condition; consequently, the forest would obtain its main supply of water by the trees projecting their roots downward far beyond the limits of surface moisture. But our argument is now directed primarily to a hygienic point, and secondarily to the means whereby unproductive land may be brought to a condition in which crops may be insured at a minimum expense and at the greatest profit to the cultivator. In a future paper I will resume this subject, and endeavor to prove that forest trees return to the land and air more moisture than they extract from surface soil.

The conclusions apparent from the facts and arguments herein advanced are the following: that forest trees in sufficient number will absorb, from deep as well as from superficial strata, a sufficient quantity of water to establish regular subterranean currents, and that whatever miasm may be combined with or held in solution by the water will thus be carried off, or have its toxic properties in whole or in part neutralized; that the water thus exaled will be diffused through the atmosphere in such quantity as to be returned in great part to the surface soil by precipitation; that the high Summer temperature may thus be so modified as to reduce the nocturnal heat below sixty degrees; that the causes thus operating to prevent vegetable fermentation, or to dissipate miasm if developed, would protect the valley from regular visitations of paludal fevers; that the modification of climate thus induced would, under ordinary circumstances, insure average crops of grain in localities which are now dependent either on unusually wet seasons or on artificial irrigation; and that, while immediate benefits would thus be conferred upon the farmer by extensive tree planting, the remuneration would be cumulative, not only in the regularly increasing value of his timber, but in the prospective reclamation, by natural processes without absolute expense, of land which is now utterly useless.

From the foregoing remarks it may not be inferred that the writer denies any prophylactic agency to the aroma of trees; their reputed virtue in this respect cannot be either entirely ignored or satisfactorily proved. On a speculative basis, there are many arguments in favor of the theory; from a strictly scientific point of view, much investigation will be required before adequate testimony will be accumulated to raise it above a popular belief. The object of this paper has been to bring known principles of vegetable physiology into relation with some of the causes which originate certain forms of disease.

DRAINAGE OF BUILDING SITES—SUBSOIL AND HOUSE DRAINAGE, ETC.

By THOMAS M. LOGAN, M. D., Secretary State Board of Health.

In the following remarks I shall avail myself of the valuable contribution to "Sanitary Engineering," by Baldwin Latham, C. E., London, and also the elaborate work on "Farm Drainage," by Henry F. French, of Concord; the principles and processes applied in the one instance being equally applicable to the other.

In all works of sewerage, in order to get their full benefit it is requisite that provision should be made for the drainage of the subsoil. The mere fact of carrying out a system of sewerage, and being obliged to cut through various strata of a more or less retentive character, is naturally a means of securing, to a great extent, subsoil drainage. But it is not well to depend entirely upon the intersection of various geological formations; for it has been shown that drainage-works, when first brought into operation, or during their construction, have had greater effect in drying the subsoil, and in reducing the death-rate by phthisis, than has been secured in after years. This may be accounted for from the fact that the drainage of the subsoil was more perfect prior to the complete consolidation of the sewer trenches than it has been subsequently. In designing a system of sewers, therefore, the engineer should make provision, more especially in retentive geological formations, for the effectual drainage of the subsoil, the works for which purpose should be constructed and carried out so as to prevent any chance of sewer water percolating into the surrounding ground. This part of the subject belongs more properly to the sewerage of cities.

At present, we wish to confine our attention to the drainage of farms and country seats. It is well known that a soil perfectly saturated with water, which can only part with its water by evaporation, is rendered cold and unwholesome as a site for human dwellings; for all impurities that enter the soil accumulate. Soils which are naturally porous, from which rain rapidly disappears, are known to be the healthiest situations for the sites of houses. It has been clearly shown from experiments, that the effect of drainage upon ordinary agricultural land is to render it less capable of conveying extremes of temperature. Undrained fields are sooner affected by the lower temperature of Winter, or by sudden showers of rain or snow, than fields of the same class that are drained. The object, therefore, in view, is, at the least cost, to relieve the soil of surplus water, or water that is not held by attraction, or, in plainer terms, water that will run out of the soil. Ordinary soil, thoroughly dried, will receive about half its bulk of water before any drains off, so that one and one half feet of such soil may hold by attraction half our

annual rainfall, which is twenty inches. Much land, hard and firm, which is covered with water forming ponds and pools during the rainy season, although apparently dry during the Summer, is yet often filled nearly to the surface with *stagnant* water, which cannot percolate through the hard-pan flooring. Such land, as well as all land in which water is found at any season within three to four feet of the surface, needs draining for health. Land in which water will be found at a depth of two feet in any part of the growing season, needs draining for agriculture. How is this to be effected?

To drain a tract, large or small, one acre or ten thousand acres, find an outlet low enough to give the necessary fall. One foot in one hundred is sufficient—in fact, a quarter of that fall sometimes answers. If the fall be slight, greater care will be necessary in laying out the work and performing it. Common drain tiles are recommended, rather than stones or wood, and the directions given are especially adapted to the use of tiles. They are usually about twelve inches long. If the four-inch are not large enough, two or more lines of them abreast may be laid. Miles of drains have been laid with a conduit no larger than a single four-inch pipe. The work should be all laid out before breaking ground, and in general a day's service of a competent engineer, to lay out the work and fix the grades, will be worth far more than it costs. Usually, a single drain should run through the lowest part of the tract, and it is not important that the main should be straight. Having laid out the main, lay side drains running into it, having in view two principles: first, to run each drain up and down the slope of the land rather than across; and, second, to have them parallel to each other. The depth should be four feet or more, and the distance apart, with this depth, may be from thirty to fifty feet. In any soil, except a close clay, fifty feet apart will be a safe distance.

To open them, begin at the outlet, so that the water may run off as the work proceeds; and with a common spade, and a pick if necessary, cut a trench, by a line, eighteen inches wide at the surface, narrowing to four inches, or the width of a laborer's boot, at the bottom. Having opened all the drains, keeping the main low enough to let off the water, then lay the tiles at the upper end. If there is much fall, and there is danger that the main, or lower end of it, may cave in, it may be only partially excavated at first—just enough so that the water may run off from above. Lay the first tile, usually of two-inch size, with a brick or flat stone over the upper end to close it entirely, and the next, end to end, with it, and so on to the main, keeping always an inclination, however slight; for if any depression is made the silt will lodge in it and obstruct the work. In this system of drainage no water is to be anywhere admitted, except by percolation through the soil. There must be no opening to the surface, or into any ditch, or to receive sink-water, or anything but clear water, creeping underground, which gets in chiefly at the joints. Nothing short of cementing the joints can keep the water out. The great difficulty is to keep out silt or fine sand. Having laid two or three tiles on the bare earth, cover each joint half or more round the tiles with a piece of tarred paper, as large as a common letter envelope, and, holding the whole firmly, place soil or gravel over it and on both sides of the tiles, pressing it enough to keep them in place. Cover and fill up with anything at hand, except soft clay or fine sand, which should not be placed in contact with the

tiles. When approaching the junction of the minor drain with the main a curve should be made, so as not to bring in the side-stream at right angles. The capacity of pipes with round bores is nearly in proportion to the squares of their diameter. The square of two is four, and the square of four is sixteen; so that a four-inch pipe theoretically carries four times as much as a two-inch pipe, and actually carries more—the friction being less in proportion in large pipes. Again, water running down hill, in a smooth pipe, gains by accelerated velocity—as any falling body does—and the stream grows smaller as it flows swifter, and so requires less space to carry it. If, however, a pipe be running full, this acceleration is retarded, because the stream cannot lessen its bulk without leaving a vacuum The admission of side-streams fills this vacuum, and thus allows the main stream to run faster. With considerable fall the main pipe may, in fact, be much smaller than would seem possible with reference to these principles. In one case, in England, it was found, by actual experiment, that the addition of eight junctions, each of three inches diameter, into a main line of pipe of only four inches diameter, so increased the velocity of the stream that there was no increase of its sectional area. Having thus connected the drains in one system, with only one outlet, this should be secured by a wire grating, and have a clear fall of a few inches, upon a flat stone, that it may not be obstructed by back-water and mud. I have been thus particular in making an abstract of the instructions, already referred to, how to drain a field or building lot, because the same rules are applicable to the drainage of buildings. Another, but less practicable mode of drainage, because stone cannot be always procured without much expense, is that of which an example was made on the grounds of the San Francisco Almshouse. On the northeast corner of the tract was a little swamp, probably about three and a half acres. This marsh was kept moist and damp by springs of water, and proved the source of miasmatic exhalations. This land was reclaimed by causing a number of ditches to be dug, about six feet apart, and deep enough to get down to a solid foundation. Stone was then hauled from a neighboring quarry, and placed in a layer, one foot deep, and then covered over with sod. The ditch was now filled up with soil, forming what is known as the "blind drain." The inmates of this institution are no longer plagued by malarial affections, while the reclaimed land more than supplies the house with vegetables.

HOUSE DRAINAGE—SINKS AND WATER-CLOSETS.

We have thus far been dealing only with clear water, to be conveyed in pipes, that may take in or let out water at every foot. Such drainage is entirely distinct from the drainage of sinks and the like, which requires pipes much larger and smoother, and also close-jointed. As a rule, the works of house drainage are carelessly and thoughtlessly carried out, and often inflict untold injury on the luckless occupants of the house in which they are executed.

It appears that there is no fluid so hard to carry away as that of sinks and water-closets. The soap, grease, and other matters are deposited on the sides of the pipe, and it may be said to be a mere question of time, depending on the size of the pipe and the flushing of water, how soon it will fill up. This is why the drainage of clear water should be kept distinct from that of cesspools and sinks. The following method

is reported as having been in successful use for five years, with a fall of only about one in a hundred: At the sink is a common bell trap; a lead pipe, of one-and-a-half or two-inch bore, runs down and out through the cellar or ground into a reservoir, which should be of well-cemented hard brick, and should be a foot or more below the surface. The lead pipe should discharge under water; and so we have a second trap, that prevents any air passing up the pipe. The outlet pipe, starting about one third up from the bottom, may be of lead, one-half to two-inch bore, and should run upward and out of the reservoir at about a third from the top, and into a large pipe of stone or iron. Thus the water enters the lead pipe about midway from top to bottom, leaving the greasy particles floating on the top and the heavy particles at the bottom, so that what runs off is comparatively clear. It still carries off a great deal of soap, and will deposit it for a long distance. The final deposit, or cesspool into which sinks and water-closets are discharged, should be placed, if possible, below the level of the water in the wells at their lowest, and always on the down-stream side of the well, as the water is supposed to flow in the ground. A large vault may be supplied with a quantity of dry soil, and the moisture may be thus absorbed; or a trap may be there arranged, which shall separate the fluid, which may be pumped out and applied to the soil; or the moisture may be absorbed by the earth, if the conditions are such as to render it safe.

A judicious application of the principles I have thus collated, will enable any one of ordinary common sense to take the precautions essential to health, so far as relates to house drainage.

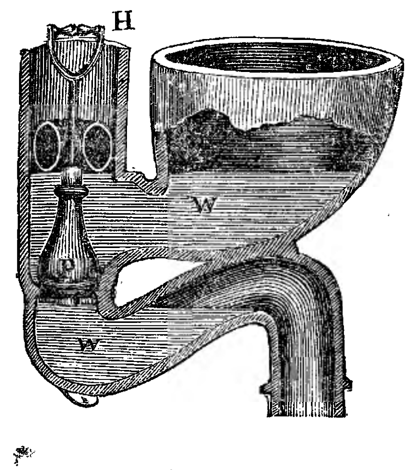
WATER–CLOSETS.

The requirements of a good water-closet are, that it shall be inodorous, shall work efficiently with a minimum quantity of water, and shall be simple in construction and not liable to get out of order. There can be no doubt that many water-closets which are now in use are extremely defective in the principle of construction, and when introduced into a house, instead of being a comfort and luxury are a positive nuisance, and often endanger the health of its inmates. Most of the complaints which have been raised against the water-carriage system have been directed almost solely against water-closets, as being the source of nuisance, when introduced within a house. These complaints have in many instances been well founded; and the remedy is, not to abandon the water-carriage system, but to correct the defects which have given rise to these complaints. A good water closet is the only appliance fit to be used within a house, for by it all matters are at once conveyed away, and cease to have the power of producing evil, so far as our houses are concerned. It is not so, however, with those systems that conserve fæcal deposits within or in close proximity to our dwellings, as there is always danger in storing a dangerous article, however carefully we may tend and guard against its evil effects. It is found in practice that some of the simplest and cheapest water-closets are the best; in fact, all those closets consisting of a simple basin and trap, usually called the Hopper closet, if provided with ample water for flushing, can be used without causing any nuisance, as there is no space for noisome gas to accumulate, and no exposed area, plastered with fæcal deposit, to generate foul gas. If the closet is provided with

ample ventilation,(1) no gases can pass back through the trap to cause any mischief.

Many of the Hopper closets in use, owing to defects in the construction of the trap, and from the inadequacy of the flush of water, do not clear themselves at every discharge of the closet. The consequence is that fæcal matter is left in the trap, and its exposure often gives off a bad odor. Those who require a still more perfect closet than the simple basin and trap, will find Jennings' closet a perfect sanitary appliance. It consists of a basin and trap made in one piece of earthenware, but instead of the small quantity of water usually supplying the trap of a Hopper closet, in this case a hollow plug (P), is used to dam up the water in the basin. The consequence is that the fæcal matter is at once dropped into a large volume of water (W), and to a certain extent it is immediately deodorized, as those peculiar organic odors given off by fresh fæcal matter are prevented from escaping; and when the handle (H), which lifts the plug, is raised, everything in the basin is suddenly discharged into the trap below, and so into the drain. The hollow plug also serves as an overflow, if the basin fills too high.

JENNINGS WATER CLOSET.



URINALS.

As a matter of convenience, and as a preventive of nuisance being committed in places out of proper sanatory control, public urinals become a necessity in all urban districts. They are also required in houses, manufactories, and other places, where proper consideration and cleanliness is a matter of vital importance. A urinal, not properly attended to, soon becomes a disgusting nuisance, as urine very rapidly undergoes decomposition, and when in this state it has the power of rapidly turning fresh urine into the same state; hence the necessity of thoroughly cleansing and washing every part of a urinal. As a manure urine is by far the most valuable part of town sewage. Compared with solid fæcal discharges, the value of urine is as six to one; therefore, every effort should be made to secure the urine produced in a rural district for agricultural purposes. In some manufacturing towns urine is

(1) This may be effected by carrying up the soil pipe to the roof, or some other convenient point, care being taken that no windows, house ventilators, or the flue of a chimney shall be near the point of termination, as at times there are in-currents into the house at these points. If it is necessary to carry the soil pipe up to the ridge, the pipes for this purpose may either be carried inside or outside the roof; but in all cases it is better and safer to place both the soil pipe and all other pipes, in connection with the drains, outside the house. The same provisions should be made for the ventilation of urinals, general details of which will soon be considered.

regularly bought and collected in lant-carts for use in fulling of woolen cloths.

A great variety of forms of urinals have been introduced at different times, and have now become articles of common manufacture. They are usually made of glazed earthenware, and sometimes of common stoneware. In the distribution of water to a urinal, care must be taken that every part of the urinal is properly washed. The volume of water required varies greatly with the description of urinal. In those cases in which the urine is discharged into a trough, and the water merely used as a diluant to assist in washing away the urine, the volume of water required is small; but in cases in which stalls are used, and a constant supply is provided, this supply is often equal to half a gallon per minute. The water in basin-urinals is distributed by a flushing rim, and in stall-urinals, either from a perforated pipe or a spreader made specially for the purpose.

Urinals are generally trapped with the ordinary siphon trap, and provision should be made for the ventilation of the drains communicating with a urinal; especially in cases in which they are constructed inside houses. The best mode of ventilating urinals is to carry up the drain-pipe in the same way as the soil pipe of a water-closet is treated. In many cities of Europe, the provision of public urinals has had a fair share of consideration, but it is to be regretted that this sanatory measure is so little regarded in America. The same remarks apply to public latrines. Accommodation of this class, as a rule, is only provided at the various railway stations or hotels; but even here, they are neither as convenient, or as well attended to as they should be, and the roving public have to suffer, in consequence, much serious inconvenience, and sometimes serious injury to health. All public as well as private urinals and latrines should be so constructed that while they are sufficiently screened from public view, they should be readily accessible, and nothing repulsive to privacy or decency be permitted.

THE DRY-EARTH METHOD OF TREATING REFUSE.

By SAMUEL LEAVITT, New York.

[Read before the New York Public Health Association, October 23d, 1873, and published in the "Sanitarium" for May, 1874.]

THE EARTH—CLOSET.

This system was introduced into Lancaster, England, by Mr. Garnett, of Guernmore Park.

In eighteen hundred and seventy, the earth arrangement was taken in hand by the corporation, its use having been demonstrated. In eighteen hundred and sixty-nine there were two hundred privies of this sort in Lancaster. The stools were not covered in detail, but Mr. Garnett's men supplied earth to the pits once a day. No slops entered those pits, and not all the urine; for besides the men's day urine, which here, as elsewhere, would commonly not go into the privies, Mr. Garnett had an arrangement which extended to one hundred and seventy out of four hundred and fifty families, by which the urine of chamber vessels was kept from the closets. It was collected in large vessels and removed daily. A shilling a quarter was paid to those who would thus keep their urine separate. (1) At first, the ashes of the town were mixed with earth, but ashes [Bituminous, S. L.] are now discarded, though the street sweepings are found available. The dried earth is broken up by a steam-turned roller, and is screened so that it is a dry brown powder when used. The report states, that as compared with water-closets, as usually kept in similar parts of towns, there is no question that greater cleanliness and less offense are attained by the earth-closets, in the poorer neighborhoods of Lancaster.

Again, the death registers show that few or none of the deaths from diarrhœa and typhoid have been in houses provided with earth-closets; and the medical men of the town agree in stating, that since their introduction, fever has almost wholly disappeared from parts of the town where it was formerly rife.

Dr. Buchanan thus sums up some of the

ADVANTAGES OF THE EARTH SYSTEM.

1. The earth-closet, intelligibly managed, furnishes a means of dis-

(1) I believe that the time will come when, even in the largest cities, a system of main and branch pipes will be laid for conducting urine to the wharves, where it will be received in barges containing tanks. It would not be such a difficult matter to take it away from each house in close vessels. This outgoing fluid would be worth much more to those who took it away, than is the milk which is brought into the city in such quantities.

posing of excrement without nuisance, and apparently without detriment to health.

2. In communities, the system requires to be managed by the authority of the place, and will pay at least the expenses of its management.

3. In the poorer class of houses, *where supervision of any closet arrangement is indispensable*, the adoption of the earth system offers especial advantages.

4. This system does not supersede the necessity for an independent means of removing slops, rain water, and soil water.

5. The system might be at once applied to any town of ten thousand inhabitants.

6. As compared with the water-closet, the earth-closet has these advantages: it is cheaper in original cost; it requires less repair; it is not injured by frost; it is not damaged by improper substances being thrown into it; and it greatly reduces the quantity of water required by each household.

7. The whole agricultural value of the excrement is retained.

In a paper read before the Glasgow Sewage Association, March thirtieth, eighteen hundred and sixty-eight, E. C. C. Stanford, F. C. S., says:

"Water is a mere carrier, and no disinfectant; its cost, also, from the great quantity required, is very considerable. The whole system of sewerage by water-carriage is extravagant. It carries the solid and liquid excreta down to our neighbors to rot at their doors, and leaves us a legacy of deadly gases, to remind us that our effort to cheat nature has signally failed. As applied to even ridding ourselves of the nuisance, it is the finest effort of the 'circumlocution office,' and the best illustration of how not to do it in our generation. Engineers have employed an elephant to do the work of a mouse, and the burly brute has trodden down and laid waste the country."

In another paper before the Glasgow Philosophical Society, Mr. Stanford says:

"Our authorities want, of course, some grand scheme, but they forget that the question is one of minute details. We are assailed by a large army of small nuisances—one at least to every house—and we must attack them one at a time. Attacked in their united strength, they will assuredly overcome us."

THE NEW SYSTEM IN AMERICA.

The introduction of the earth-closet into this country is largely due to the labors of George E. Waring, Jr., of Newport, who has written several books on the subject. He thus criticises the popular American system of treating human excrement:

"The water-closet is the chief thing of which women living in the country envy their city cousins the possession. In country houses, one of the first steps towards elegance is the erection of an expensive water-closet in the house, provided with a force pump that is doomed to break the back and the temper of the hired man; a tank and pipes, which are pretty sure to be burst by frost every Winter; the annual tax of the plumber's bill; and, worse than all, a receptacle in the garden known as a 'cesspool,' which usually has a private subterranean communication with the well from which drinking water is taken. The manure is, of course, lost; it is worse than lost. Too far below the surface to be of use to vegetation, it lies a festering mass, sending its foul and poisonous gases back through the soil pipe and the kitchen drain into the house, and

developing in its putrid fermentation the germs of typhoid fever and dysentery that any film of gravel in the lower soil may carry to the well or the spring. * * * Hence comes typhoid fever, *of which no single case ever occurred in a civilized community without the direct intervention of human agency.* * * * Out-of door privies, those temples of defame and graves of decency, that disfigure almost every country home in America, and raise their suggestive heads above the garden walks of elegant town houses, are, I believe, doomed to disappear from off the face of the earth."

Mr. Waring quotes as follows from Professor S. W. Johnson, of Yale College:

"The guanos and fish manures, which are brought from a distance or manufactured at a heavy cost for our market gardeners, are in reality paid for, not by them, but by those who purchase their produce in the city markets. The animal who stands at the head of creation requires the richest food, and yields to the food-producer the richest return. It requires but little art to convert *his excrement into increment*; the conversion may be made extremely profitable. The excreta of a man have been valued in Flanders at nine dollars per annum, and the Chinese agriculturist will give a day's work for ten gallons of urine."

Writing of the destruction of American soil, Mr. Waring says: "Fortunately it will not continue always. So long as there are virgin soils this side the Pacific, which our people can ravage at will, thoughtless earth robbers will move West and 'till' them. But the good time is coming when (as now in China and Japan) men must accept the fact that the soil is not a warehouse to be plundered, only a factory to be worked. The sewers of London wash into the sea the manurial products of three million people, to supply whom with food requires the importation of immense quantities of grain and manure. The wheat market of one half the world is regulated by the demand in England. She draws food from the Black Sea and from California; she uses most of the guano of the Pacific islands; she even ransacks the battle-fields of Europe for human bones, from which to make fresh bones for her people; and in spite of all this her food is scarce and high, and bread riots break out in her towns."

Nearly all the earth-closets in use in this country are modifications of that of Rev. Mr. Moule. The prominent manufacturers are the Hartford Earth-Closet Company and the Wakefield Company. The latter have introduced a large number of their closets into Central Park. Mr. Waring says truly that, "besides the need of this system in smaller towns, there are portions of this city where something of the sort is absolutely necessary. The whole Harlem flat is so low and level, that it will be almost impossible to lay the sewers so high as not to be entered by salt water at high tide."

It has been demonstrated in England that street-sweepings are available for the earth-closet. I believe that it is entirely practicable to use this system for the whole city thus: Let there be a depot-shed in each ward or precinct, to which all the best and driest of the street-sweepings shall be brought and all the ashes. Let the carts dump their loads upon coarse screens, to remove all such refuse as tin and crockery. Let the dirt pass through rollers or stamp mills, and then through revolving screens; and when duly prepared be taken to the earth-closets, and thence to the country. When desired, it can pass several times through the closets. Thus, instead of an expensive removal of street dirt and

ashes and night-soil, the city can send these three "nuisances" away in the form of the most valuable known fertilizer.

It is probable that this business will prosper in small towns faster than in cities or isolated abodes. The latter will not take the trouble, and the cities will use water-closets until shamed out of the practice. But individuals will start Dry-Earth Companies in towns, as has been done in New Haven, and will soon so demonstrate the merits of the plan that the municipalities will adopt it. The lack of such companies furnishing earth and removing the product, has been the only obstacle to the rapid spread of this great reform. A United States Dry-Earth Company should be formed, which would put itself in communication with the coal dealers throughout the country, who have sheds, screens, and carts, and are in the habit of removing ashes. This company should induce the coal dealers to sell all the varieties of closets, furnish dry earth, and remove and sell the fertilizer; and they should be guaranteed a fair price for the condensed grades of the latter, at a central depot in New York, when neighboring farmers did not want it. Such an organization would cause the system to spread like wildfire.

The first apparatus patented in this country for such use of earth was the "Excelsior Sanitarian Cover" described below. The patent was dated in eighteen hundred and sixty-six. The first Moule commode was imported into this country in eighteen hundred and sixty-eight. The following testimonials will show the progress of the reform as represented by the Moule, Wakefield, Hartford, etc., closets:

"It is the best means of disposing of night-soil. It is particularly valuable in this city, and in all localities where similar [imperfect] conditions obtain with regard to drainage." J. H. Rauch, Sanitary Superintendent, Chicago.

"The system of earth-closets at Fort Adams, R. I., appears to have at length settled a question which for twenty years or more has been a source of perplexity, trouble, and expense." J. F. Head, Surgeon United States Army.

"From ten to twenty earth-closets have been in constant use upon the Brooklyn parks during the last year. We are introducing them in preference to water-closets, even where water supply is already secured and sewers laid." Olmstead, Vaux & Co., Landscape Architects and Superintendents.

One hundred Wakefield closets are now (eighteen hundred and seventy-three) in use in the Central Park, New York.

"As Chairman of the Committee from the Boston Board of Aldermen appointed to assist at the Jubilee Festival, I had occasion to observe the working of the earth-closets, and they appeared an entire success." E. A. White.

"This is one of the cheapest and most useful discoveries of modern times." Mass Board of Health.

"The most important sanitary discovery of the age." Wm. Lloyd Garrison.

"Whether regard be had to economy, health, or decency, the earth-closet is *facile princeps*." Howard Potter, of Brown Bros.

The following persons give similar testimony in favor of the system: Stephen Smith, M. D., New York Board of Health; R. W. Brady, S. J., President of College of Holy Cross, Worcester, Massachusetts; B. Evans, Superintendent State Reform School, Westboro, Massachusetts; L. D. Wilcoxson, M. D., Connecticut State Hospital; J. F. Whiting,

Mayor of Rahway, New Jersey; W. C. Chapin, Pacific Mills, Lawrence, Massachusetts. The principal Methodist Camp has ordered its universal use on its grounds.

THE EXCELSIOR SANITARY COMPANY

of New York, claim to have issued the first patent for earth-closets in this country, viz: in eighteen hundred and sixty-six. However that may be, they have certainly developed some useful inventions. Their best addition to sanitary apparatus seems to be a hollow cover.

The invention consists of a hollow compartment in this lid or cover, for the reception of a suitable deodorizing compound, with openings in the under part, through which, when desired, by turning a handle, the preservative agent is thrown into the chamber-vessel—part before, and part after the vessel has been used, thus bringing the antidote in immediate contact with, and enabling it to overcome, the poison.

Something of this sort is certainly called for, besides the stationary earth-closets, for sick chambers, and many other places where regular closets cannot be used. It is acknowledged by all sanitarians that even the carrying of vessels which emit foul odors and poison the air, from the chamber of a patient to empty, is one of the most prolific sources of the spread of cholera. Through a series of complications, such as often befall patents, this useful invention is only now being put on the market. All physicians who have seen it are loud in its praise. It is peculiarly adapted to act as a pioneer in this line, because being so small it can be put away in any corner or closet, and kept full of earth ready for sickness, or a rainy day, or a day when the water-closet is broken or frozen. The recent addition of a galvanized iron receptacle—the size of a large slop jar—with a wooden privy-seat rim, makes it a complete earth-closet. J. G. Collins, Sing Sing Prison, said of this machine: "It is just what is wanted for all our prisons. I cheerfully recommend its introduction into each and every cell of each and every prison." Theodore Dimon, Physician of Auburn Prison, said: "The agent of our prison has determined to have one of your hollow covers attached to each night-pail in every cell of this prison. * * * This will enable us to keep them in use, without cleaning out, for say a week, or even longer. The evening march of the working convicts to the pail-ground would be saved, and much exposure to rain and sleet avoided." D. B. McNeil, Inspector of State Prisons, said: "I am satisfied, from experiments made here under my eye, that it is highly valuable and wholly indispensable for purifying the cells of all prisons."

THE GOUX SYSTEM FOR CITIES.

There are a few considerations that make the Goux system especially applicable to this city at present. Perhaps the most important of these is that the company introducing the process here are already running wagons carrying their peculiarly prepared tubs to and from the houses of customers. This does away with the principal obstacle to the use of all these machines. A description of the system will show what are its other advantages. M. Goux's invention reverses the earth-closet system by placing the great bulk of the disinfectant and disintegrating material in the receiving tub before it is used at all. A layer of any dry absorbent material (preferably earth, ashes, or peat, though sawdust, cut straw, and similar substances seem to answer nearly as well,) is placed over the

bottom to such a depth that when the mould, which is a close-covered kettle, is placed on it, the upper edge of the mould will be on a level with the upper edge of the tub. Additional absorbent matter is now packed round the mould, so that when it is withdrawn, the vessel, with its packing, shall present a receptacle in the center the size of the mould. With the absorbing material used there is mixed a small quantity of disinfecting powder—sulphate of iron or green copperas—and there is a simple arrangement placed beneath the seat, whereby every time the closet is used, a shower of this disinfecting powder is sprinkled over the vessel and its contents. As soon as the dejections reach the vessel, the fluids are all absorbed by the porous substances on its sides and bottom. The solids are therefore left in a comparatively dry condition, and putrefaction is prevented, while the odor is neutralized by the disinfecting powder. It is claimed that the powder is not needed in outdoor closets.

It will be seen that the special advantages of the system are the utilization of the sweepings of houses, stores, and factories, for packing, the use of a powerful disinfectant, and the infallible prevention of nuisances, sometimes still contingent upon the use of earth closets, from neglect or disarrangement of machinery, or failure of earth supply. That which is to negative the most of the natural offensiveness is already in the tub, and will do its work even in the face of intentional neglect or willful attempt to make mischief.

So much can be honestly said in favor of this system. The claim of its backers, that it supersedes the earth-closet, is not admissible. The latter is nature's true democratic form of governing this important matter. If its product is rather bulky, so much the better; it will stay near and be used upon the soil that furnished the aliment that produced it. Monopolists cannot send it to fertilize distant lands. It may even be considered unfortunate, except so far as city product is concerned, that the dry earth can be used safely, half a dozen times, and the fertilizer thus condensed.

The Goux Urinal is a tall cylinder, in which is placed a funnel with a long perforated tube. The cylinder is so packed that the tube reaches to the bottom, while at the same time it is surrounded by absorbing material, mixed with disinfecting powder.

This system has already been introduced largely in Europe, and after a protracted trial made at Aldershot, during eighteen hundred and seventy-one, the British War Department, on the recommendation of several sanitary commissioners, specially appointed, has determined to adopt it. Although the contract was made and arrangements prepared for about four thousand men, yet the service has extended, without difficulty or inconvenience, to about eleven thousand or twelve thousand men, and no complaints have been made. In eighteen hundred and seventy-two, about fifteen hundred closets were in use every day in Halifax, England, and several large towns and villages in the manufacturing districts were making arrangements to introduce the Goux system.

This is a very important fact, for the Moule system had the start, and as the English are looking very carefully into this matter, it is a proof that they have found the Goux system specially adapted to the use of the rough, careless, slovenly men who usually inhabit barracks, prisons, etc. It is said that there are now about ten thousand Goux closets in use in England.

The *Scientific American* of January first, eighteen hundred and seventy-two, in an illustrated article on this machine, said:

"This form of earth-closet has been extensively introduced in London, where a corporation, known as the Sanitary Improvement and Manure Manufacturing Company, has been formed, and a large and profitable business inaugurated. The company employs a large number of drays and men, who go around to regular customers, removing the filled tubs and replacing them with others. The Town of Halifax, England, has also adopted the system, and will be soon entirely fitted. The Towns of Bradford and Wakefield, after a close examination of the results obtained at Halifax, have decided on adopting the system, and the company is in treaty with several other corporations for the same purpose. For hospital purposes, the system is excellent."

In the report of the Medical Officer of the Privy Council of England (eighteen hundred and seventy) appeared the following earlier testimony for the Goux closet: "This system is now somewhat extensively tried at Salford. The ordinary midden-closet can be converted into a Goux pail-closet at trifling cost, by cleansing out and filling up the midden, and paving the floor beneath the seat. An examination of the amount of nuisance arising from a pail-closet, as compared with the old type of midden-closet, in Salford, led us to conclusions largely in favor of the former. In no instance did we find offensive smell from the pail-closet. *With proper care*, they can never give rise to the abominable nuisance which is almost inseparable from the old form of midden."

THE PNEUMATIC SYSTEM.

CAPTAIN LIERNUR'S IMPROVED SYSTEM OF HOUSE DRAINAGE.

By ADAM SCOTT, C. E.

[From "The Sanitary Record," London, November 21st, 1874.]

The sewage difficulty is one of the most vital questions of the present day, owing to the many perplexities into which the existing sewerage system—the water-carriage plan—has brought so many of our towns. Any system of dealing with it effectually deserves the most careful consideration.

There are many reasons to believe that Captain Liernur's plan has solved the problem in an efficient and satisfactory manner. His method of treating sewage having been in use for some years in Continental towns, the arguments he uses are not theoretical only, but are based on accomplished facts, his plans having had the advantage of a practical trial and having been found equal to the test. We propose, therefore, to examine it in detail.

Captain Liernur commences with the axiom that the aim of a town-drainage scheme should be not merely to remove filth, but, in addition to this, to keep air, soil, and subsoil water in a pure condition, and to maintain the last mentioned at a permanent low level. Hence he makes it his task to satisfy in the most perfect manner these various requirements, and he succeeds in it, as presently will be seen, without causing any nuisance whatever, and without laying any additional burden upon the ratepayers.

This last point is, in Captain Liernur's opinion, of very high importance in a sanitary sense, and perhaps more than many think; the doctrine of a great number of hygienists being that no expenditure can be too great for securing public health. Captain Liernur, however, points with great show of reason to the fact that the expenditure of large sums, without a return in kind, involves always an increase of taxation and consequent increase of house rent, which means for the working classes nothing else than crowding them still closer together in their already overcrowded dwellings, and in increasing the price of provisions and all necessaries of life. Now nothing contributes more to sickness and death in a town than such a condition of affairs, even apart from the general prostitution with all its horrors which accompanies it; hence it is that so-called sanitary works are of but little avail for improving the general health of a town if they are executed at the cost of

the comfort of the poor, no matter how beautifully such sanitary works may be carried out. Captain Liernur insists, therefore, that their aim should not only be to remove filth and to maintain the general purity of air, soil, and subsoil water, but also to give the working classes roomier habitations and an abundance of cheap and wholesome food, which, he maintains, can be done by a proper utilization of the sewage.

Accepting the above as the true basis upon which a scheme of town sewerage should be founded, it is apparent that our present system is entirely wrong. We remove the filth, to be sure, by means of fine-built sewers, water closets, and gigantic masses of water, but not without polluting air, soil, and subsoil water as we go along. We are constantly reminded of this by distressing cases of typhoid fever and other zymotic diseases, caused by sewer-gas poisoning, pollution of rivers, and by unceasing demands made upon the pockets of the community, in the as yet futile hope of remedying this truly miserable state of affairs.

In fact, it cannot be otherwise, when, regardless of chemical laws or the demands of sanitary science, we continue to remove the whole of the fæcal and other town refuse which is capable of being removed by water-carriage, in one common sewage conveyance, and wash it all pell-mell into the nearest stream. The system at present in vogue succeeds in getting, at a great expense, an indescribably nasty mess out of town to puzzle our engineers, and in creating still more noxious elements of pollution and disease inside to distract our sanitary authorities.

The leading principle upon which Captain Liernur acts is that of separation, in contradistinction of the present system of commingling everything in one sewer, his method being "*divide et impera.*" He classifies sewage in a similar manner to that which a carrier adopts in the transport of a mixed cargo of fragile and costly, and heavy and valueless goods, viz: by assigning each variety a distinct and separate conveyance, rather than by indiscriminately jumbling up the entire freight, thus doing enormous damage.

Thus he confines the duty of the sewer proper to the work of water-drainage only, and does not allow any putrescible matter whatever to enter therein.

Excrementitious matter of every description, such as the contents of closets and privies, chamber slops, and the fatty sedimentary products of kitchen sinks (which contain substances of a fæcal nature, but not yet in a state of putrefaction), are therefore all kept out of the common sewer, the arrangements for doing so being highly ingenious, simple, and effective.

Nor are the waste products of industry allowed to enter the sewer. Captain Liernur lays it down as a general rule that whoever makes water foul for the sake of his own private profit, must purify it before discharging it in the stream or sewer, and must do this at his own expense, instead of burdening his fellow-citizens with the refuse it contains. However disagreeable this purification may be to the manufacturer, there is no doubt that the principle is a correct one, as the solution of the sewage problem is simply an impossibility if the foul waste water of manufactories is allowed to complicate the question. Captain Liernur propounded and demonstrated this doctrine in the discussion on the sewage question at the recent Social Science Congress at Glasgow, and it deserves mention that it met the unanimous support of his many hearers, including the Chairman of the Section, the Right Hon. Dr. Lyon Playfair, M. P., who expressed himself most emphatically in this sense. Captain Liernur pointed out that it is comparatively easy to

cleanse factory water by separation, and in each individual case, the exact polluting elements being known and their presence constant; when, however, they are mixed with each other, with excreta and all sorts of other filth, are diluted with copious masses of water, and, to make matters still more perplexing, vary each day in volume and constituents, the work of cleansing becomes practically impossible; and even if anything like a purification method had after much research and experimenting been discovered, the erection of the very first additional factory, mixing again new elements of pollution with the mass, would make that method completely useless, and compel us to make new researches and experiments *ad infinitum*. Now, it must not be forgotten that the sewage difficulty, as a whole, is chiefly due to the part the waste products of industry play in it, and that it has cost already immense sums to overcome its evils and miseries. These sums come out of the pockets of the ratepayers, and are principally contributed by the working classes, who form by far the bulk of the population. Practically, it is thus the workingman, now earning with difficulty enough to support his family, who pays the bill which the manufacturer, by objecting to clean his own waste-water, declines to honor. The crying injustice of this is the more glaring from the fact, now on all sides acknowledged, that all the money has thus far been paid in vain, seeing that the methods on which it has been expended have all proved utter failures. Captain Liernur admits that in some special cases it might be an injustice to the manufacturer to make him bear the sole cost, and he suggests in such cases that the community should contribute towards it; but he insists upon a separate purification under any circumstances, as the only means of having it done at all. It must, however, be observed that, as actual experience has shown, it generally pays the manufacturer to do so, as the value of the product recovered generally covers the expense incurred, and often leaves a margin of profit besides. As national economy forbids any waste whatever which can be prevented without loss, it is evident that Captain Liernur's rule is a correct one on all points.

The difficulty which hitherto stood in the way of this part of the sewage question—namely, the one of detecting whether the rule of purification is absolutely attended to—Captain Liernur obviates by a very simple contrivance. A slight bend is made in the branch pipes leading to the sewer. This always retains some of the water flowing off, and on it a thin tube is erected, reaching to the pavement of the street, through which tube, by means of a small hand-pump, the Inspector of Nuisances can at any time take a sample for examination.

The result of these various arrangements for excluding from the sewer the different matters alluded to—namely, all putrescible substances and all waste of industry—is that the sewer no longer conveys anything capable of generating noxious or infecting elements. Captain Liernur does not pretend that the water comes up to the standard of purity required by the Rivers Pollution Commissioners, but he points to the fact that the Local Government Board has admitted that the remaining fluid does not come under the designation of sewage, and that authority allows of its discharge in a stream without any further treatment.

But whether the authorities take this view of the matter or not, it is unquestionable that by treating the matter as Captain Liernur does, all danger of disease from sewage is removed. Here we have, in the first place, less reference to sewer gases than to the infectious germs capable of causing disease, and contained in infected excretal matters. These

germs are certainly not killed or rendered innocuous in the sewers of our present system of carrying off excreta; on the contrary, they are cradled there in an element favorable to their growth and development, and "ventilation of sewers" merely means that we give them opportunity of escaping more readily into the streets than into the houses. Hence it is that all suggestions on this point have so little sanitary value, the best arrangement to ventilate the sewers being also the best to spread infection among us so long as they are allowed to receive excremental matters. The impossibility of destroying the germs in the sewers is, in a sanitary sense, the weak point of the water-carriage plan, and one that can never be remedied; all projects of treating sewage at its outfall, including irrigation, leaves it wholly untouched.

The implied theory as to these germs is supported, among other people, by Professor Tyndall. In his letter of the sixth instant, to the *Times*, speaking particularly of typhoid fever, which annually infects one hundred and fifty thousand of our population, he says: "The seat of the disease being the intestine, with well-appointed water-closets, it is not in the sick room that the mischief is done, but often at a distance from the sick room, through the agency of the sewer, which Dr. Budd graphically describes as a direct continuation of the diseased intestine. Hence the mystic power of 'sewer gas.'" Hence the inability of the metropolitan practitioner to trace the disease to its origin. Speaking of the poison of this disease at Over Darwen, he says, "It reaches the drinking water, it partially dries and floats in the air, it rises mechanically with the gases issuing from cesspools, and thus the pestilence wraps, like an atmosphere, the entire community."

It follows from this that irrigation, precipitation, and other methods of treating sewage, supposing them to be ever so effectual, do not prevent the pollution of town soil, and consequently of wells, and the escape of germs of disease from the sewers in the town itself.

In Captain Liernur's system, however, such poison or germs can never escape from the sewer, simply because the substances which generate them never get in it, these being removed separately, and their volatile products being imprisoned, beyond the possibility of escaping, until they are destroyed by heat and made forever innocuous.

But whatever may be the nature of the liquid in Captain Liernur's sewers, very effective means are taken to prevent this also from doing injury, as these sewers are constructed so as to be practically impervious, being built of vitrified earthenware throughout, making either infiltration or percolation impossible. At the same time the subsoil drainage is effected by means of small agricultural drain pipes, arranged in the same manner as in farm drainage, but laid at a higher level than the sewer itself, and discharging into it by means of vertical pipes, laid at suitable intervals.

The sanitary advantage of this arrangement of drain pipes, in connection with an impervious sewer, is, that they keep the level of the subsoil water at a permanent height above the sewer, allowing no fluctuation whatever. Captain Liernur's theory on this subject is, that so long as the subsoil water outside the sewer is higher than the sewer within, all danger of pollution is avoided; there being no pressure at any time to force the sewage through the brickwork, as is the case with sewers which serve both for sewage conveyance and for draining the subsoil. In the latter case the level of the subsoil water, by reason of the porosity of the sewer, often sinks down to its very invert, and when at such a time rain occurs, and the sewer fills rapidly, the

level of the liquid within it will be higher than the water without, thus forcing the former through the porous brickwork into the soil, by mere hydrostatic pressure. When this occurs, however, the soil is at once in a state of semi-moistness and in contact with the atmosphere, conditions which are known to be highly favorable for putrid fermentation and the development of organic life, if such germs are present. This we know to be the case with water contaminated by excreta, even in the minutest proportions. Such a sewer is thus practically a contrivance which always impregnates the soil with the seeds of disease at the precise moment that it has the property of a hotbed for fostering them into ripeness. Experience has taught us that zymotic diseases have, beyond all doubt, the power of spreading, without absolute contact with infected persons or objects—leading to the conclusion that contagion also takes place through infectious germs present in the atmosphere, somewhat like poisonous insects, which sting or otherwise impart into our organisms the virus of the disease due to them. We further know that the fluctuations of the level of the subsoil water cause an alternative inhaling and exhausting of air, like breathing, each rising of the water forcing a strata of air of equal height upwards; so that there is, besides the agency due to diffusion and to the difference of temperature, a direct mechanical action driving the air, charged with the infectious germs, bred in the polluted soil of our towns, into the atmosphere of our streets and dwellings.

If the theory here stated be correct (and it must be admitted to be a logical deduction from cogent premises, to which some of our most eminent drainage engineers now subscribe), it is evident that the plan of conveying sewage containing putrid organic matter, and of draining the soil, with one and the same conduit, as is done at present, is nothing less than a means of spreading the germs of infection additionally to the one above alluded to, by allowing them to escape direct from the sewer itself through means of ventilation, and would go far to explain the difficulty we have of checking typhus in a sewered town when it has once made its appearance. By Captain Liernur's plan, on the contrary, of withholding from the sewers, as far as practicable, all putrescible matter, so that no infectious germs should breed within them, and then constructing impervious sewers, and having porous drainage-pipes laid at a higher level above them, the danger of infecting the air with germs of disease by means of polluted soil, and the fluctuation of subsoil water, will be wholly prevented.

Captain Liernur claims, for his plan of keeping the subsoil water permanently above the sewer, another important advantage. It enables him in times of the maximum rainfall to keep columns of water within the gully trap-pipes, so as to exert, without any danger of polluting the soil, a hydrostatic pressure on the contents of the sewer, and thereby greatly increasing the speed of its flow. Instead of making the area of the sewer large enough to carry off storm-waters (that is for the usual proportion of this generally counted upon for removal by sewerage, namely one third,) with the speed of flow due merely to the gradient of the sewer, he calculates upon the increased speed of the flow due to the above-mentioned columns of water, in the gully pipes, to carry off that same maximal quantity with a smaller sewer, never however allowing these columns to rise higher than within one foot of the permanent level of the subsoil water, so that the hydrostatic pressure without is always greater than the one within. As the speed of water flowing through a pipe becomes greater in proportion to the increase of

the column of water resting on it, it is evident that the capacity of discharge of a small sewer, under the above circumstances, may be made equal to that of a larger one built on the ordinary plan. Captain Liernur is thus enabled to effect the same purpose with smaller sewers, which cost much less than the present large ones, and obtains also the additional advantage of scouring them perfectly free from the deposits often formed at a normal height of the sewage when its speed of flow is due only to the gradient of the sewer, and thus practically effects the "flushing" without the expensive arrangements which are commonly applied for that purpose.

The branch pipes from the Liernur common sewer terminate in a trap outside the house, and open to the air. The sewers are thus well ventilated, and cannot force any of the air (or gas if such could be formed) contained in them into the house.

Summing up the whole of the advantages which Captain Liernur's above-described plan of town drainage offers, it is undeniable that it effectually overcomes all the evils of our present system. It puts an end to sewer-gases, and thus makes the many perplexing projects for sewer-ventilation perfectly superfluous. It absolutely prevents the pollution of the soil, and fluctuation of subsoil water. It prevents also, in the most certain manner, all pollution of streams, and accomplishes these objects at a less cost than our present system, which pollutes the air, soil, and subsoil water, and the stream as well.

The next important part of Captain Liernur's plan, his so-called pneumatic system, is solely arranged for the separate removal and utilization of all putrescible matter of households capable of being conveyed by subterranean pipes. It is this which enables him to carry out his whole scheme in populous towns without increasing taxation, and, therefore, without committing the error of the water-carriage plan in this respect.

The first characteristic of this system is, that the matter alluded to is removed out of the houses by atmospheric pressure, instead of by water, being drawn, or literally sucked, by vacuum power, to a central building in the town where an air-pump engine works.

The second point deserving special attention is, that the pipes conveying the matter from the houses to the engine building are five-inch cast iron socket pipes throughout, the "mains" not being any larger than the "branches." The matter is thus removed without the use of wagons and horses, and laborers entering dwelling houses, and without the remotest possibility of the contents of the pipes polluting either the air or the soil of the town. A leak would only result in either atmospheric air or the surrounding soil rushing into the pipes, and any escape of gases or fluids is absolutely impossible. Experience has confirmed this theory, inasmuch as leaks occasioned by the shifting or settling of the pipes have been found to stop themselves. It may be mentioned also that the air pumped out of the network of pipes for creating the vacuum is exhausted by the air-pump into the fireplace of the engine-boiler, thus burning the noxious elements which such air may be charged with, and rendering them innocuous.

The third point of interest in the system is, that in the whole network of pipes there is from one end to the other not a single valve or other movable mechanism which is expected to act or to do something when the pneumatic force is applied. All parts of the arrangement are fixed and immovable. There is simply on every main-pipe one single ordinary stopcock, which is turned by hand on the street, and when

this is done all the closet-pipes of the houses connected with that "main pipe" (one hundred, two hundred, or however many there may be), are emptied simultaneously. Hence there is nothing to get out of order, to cause a nuisance, or to necessitate costly repairs. The stopcock itself is of the simplest construction, being only a conical plug in a vertical housing, capable at any time of being lifted, examined, and replaced, should it be necessary.

The fourth peculiarity is, that the simultaneous emptying of all the closet-pipes, which are operated upon by one main pipe, takes place independently of the fact that any one may receive more excremental matter than another, or even none at all. The closet-pipe nearest to the stopcock, which is the place where the motive power is applied, is not acted upon a moment sooner than the one farthest from it, and it is all the same whether a closet-pipe receives the fæces of a hundred persons or of only one individual. The arrangement by which this effect is produced is not only a marvel of ingenuity and simplicity, but is also remarkable for its absolute reliability as to regular action, being based upon a simple law of barometric resistances, operating upon small columns of the fæcal matter itself, which will be explained.

The fifth point deserving of notice is, that practically no fermentation nor evaporation takes place within the pipes. This is due to the fact that their contents are cut off from all communication with the outer air, free contact with this being, as is well known, the first essential both for evaporation and putrefaction. The excreta thus remain practically fresh until the moment of the removal, no ammonia being formed, which afterwards would require to be fixed to prevent its loss. They remain also practically unchanged as to their fluidity, so that there is no fear of "drying up," which on the one hand might limit the action of the columns of fæcal liquid above alluded to, or cause encrustations in the pipes, and thus eventual stoppages.

The sixth peculiarity is, that the matter collected is immediately converted into a dry substance called *poudrette*, by simply evaporating the water from it. This process occurs *in vacuo*, so that no organic matter can escape in the form of vapors or gases. In fact, the matter sees no daylight after being once deposited in the closet-pipes, until transformed into a harmless powder. Hence there can be no question either of a nuisance or of any loss of valuable ingredients.

The seventh and last point of interest is, that no extra fuel is used for the evaporation or distillation process. The waste steam of the air-pump engine which collects the matter is employed as a source of heat, and is found ample for the purpose in most cases. Thus all the manurial elements contained in the putrescible refuse of the town are saved and brought without extra cost into a portable form like guano, of nearly the same value, and fit like it to be shipped to any distance where there is a market for manure.

A careful consideration of the above seven main features of the pneumatic system will show that every requirement regarding the removal and treatment of putrescible matter is complied with.

The complete impossibility of its contact, either as gas or liquid, with anything outside the pipes, makes the system sanitarily perfect; the reliability of the agencies brought into play, coupled with the absence of all complicated machinery or apparatus which may get out of order, satisfies all demands from a technical point of view; and through the combination of the cheapest moving agent we have, air, with the complete utilization of the cheapest motive power we know, steam, for the

purpose of manufacturing an article for which there is a continuous and increasing demand, manure, out of substances of the highest agricultural value, human excreta, in a light portable form, everything is done which in a financial sense could be demanded.

We will now describe the simple arrangement with which Captain Liernur succeeds in obtaining these excellent results.

He selects in the town to be drained suitable places to serve as centers for the drainage of a number of houses, generally fixing the localities of these at the intersection of principal streets, so as to command from such centers areas of from thirty to fifty acres. There he places beneath the pavement tanks of from four to ten cubic feet capacity. These are cast-iron horizontal cylinders with spherical ends, constructed so as to be air-tight and strong enough to resist atmospheric pressure. Pipes are laid along the streets leading to the tanks, to act as "mains," and from these mains other pipes branch off right and left to the houses, where they are connected with the closets and other receptacles to be drained. Every tank has thus as many "mains" as there are streets leading to it. Each "main" with its branches is, however, as to its drainage action, a distinct and independent arrangement from the others, and has a stopcock for itself placed at its junction with the street tank.

When, now, a vacuum is made in the tank, and the stopcock of any one of its mains opened, all the closet-pipes connected with that main are emptied simultaneously, their contents being transferred into the tank. Experience having shown that a simultaneous action is had even with mains of nine hundred feet length, it is evident that one tank can serve for the drainage of all houses within a radius of that length, equal to an area of about fifty acres, so that the towns can be divided (other circumstances admitting this) into drainage complexes of about that size, each of which is practically independent of the others, in the same manner that each main pipe of a tank is independent of the others.

The vacuum in the tanks is, as mentioned above, created by a stationary air-pump engine, which communicates with them by means of pipes called central pipes, because they form the connecting link between the tanks and a motive agency which is common to them all. The central pipes follow only the principal streets, taking the most direct routes from the engine house to the greatest number of street tanks along their line. The length of a central pipe may, under certain circumstances, be four to five miles.

The manner in which the system works is the following: One main pipe is made to operate on a great number of houses, one tank on several main pipes, and one central engine on numerous tanks; an arrangement somewhat analogous to a military organization, where one colonel commands several captains, one captain several sergeants, and one sergeant several men.

The central pipes serve, however, not only for communicating the vacuum to the various tanks, but also for conveying their contents to the central engine buildings after their several main pipes have all contributed their quota. This is effected also by simply turning a stopcock specially provided for the purpose.

The manipulation of the system is as follows: The air-pump engine is set in motion, and maintains, during the day, a three-quarter vacuum in certain central reservoirs placed below the floor of the building, and at the same time in the central pipes. Workmen perambulate the town,

visiting each tank once a day. To drain the houses commanded by one tank, they alternately open the connecting cock of the central pipe and the stopcock of any main pipe; the first to obtain a vacuum in the tank, the second to utilize this by emptying the closet-pipes connected with that particular main. After all the mains of the tanks in question have been operated upon, and their contents collected in the tank, the workman turns the discharging cock to send the whole mass to the central building for immediate conversion into *poudrette*. He then proceeds to the next tank, there to repeat the operation.

To describe the arrangement mentioned above, for effecting a simultaneous discharge of all the closet-pipes drained by one main, notwithstanding the unequal quantities of fæcal matters collected in them, it is necessary first to explain how it is possible that air-pressure can be used at all for conveying fluid substances through pipes. It will be easily understood that this is not possible when the pipe lies horizontally. The fluid is then soon thrown to the bottom of the pipe and spread over a limited length of it, which the current of air passes over without being able to move the liquid further. But it is very practical to suck liquid up a vertical pipe without this danger of spreading, seeing that in such a case it is naturally held together and moved in mass. When, now, it is in this manner raised to the upper end of a pipe having a gradient steep enough to allow the fluid to flow down by its own gravity, it is evident that a forward motion will be obtained, equal in its effect to a horizontal movement, but without any of the fluid being left behind on the way. Supposing the gradient capable of allowing this, an inclination of one in fifty is required, then it would be sufficient to raise up the fluid one foot vertically in order to move it fifty feet horizontally; or, in other words, for every fifty feet forwards it would have to be moved one foot upwards.

It is upon this principle that Captain Liernur lays his pipes, so that they present a series of downward lines alternated by short vertical ones, or "risers," there being at the foot of every downward pipe an upward bend, in which the fluid collects to be raised anew to the upper end of the next incline. The work of moving the fluid by air-pressure, through pipes horizontally, consists thus practically in a repetition of hydrostatic lifts.

The circumstance that this is the only method for effecting his purpose, Captain Liernur now utilizes for obtaining equal resistance in all the branch pipes of the "main," irrespective of the quantities of fluid in them. To obtain this result he simply gives each branch pipe "risers" of the same height.

The effect of this is manifest when it is considered that an inclined pipe, with an upward bend at the foot of it, represents, in fact, a barometric tube with arms of unequal length, and that when both arms are filled with fluid to an equal height, the hydrostatic pressure in the one arm will be balanced by the pressure in the other. The *static* resistance then to be overcome in order to set the liquid in motion will thus be *nil*, because where there is no difference in levels, there is no hydrostatic lift. But if the liquid in the short arm of the tube is drawn upward (by suction, for instance), so as to discharge the fluid at its upper end, it is evident that the resistance increases in proportion as the level descends in the long arm, and that this resistance attains its maximum when the level is lowered to the junction of both arms. The height of the short arm represents therefore the maximum resistance to be overcome.

This being the case, it is evident that the entire contents of the long arm will be discharged before the maximum resistance is reached; and that, in fact, adding to the fluid in the pipes means nothing else but diminishing the resistance. In other words, the resistance to be overcome is *maximal* when the quantity to be lifted is *minimal*, and *vice versa*. It is hence easily seen that when Captain Liernur gives all the risers of the branch pipes of one and the same main pipe, an equal height, he limits in all of them the maximal resistance, this being just the contents of the short arm of the tube, or riser, and no more. When under these circumstances any of the long arms should contain more than is required for this purpose, the surplus will be discharged, however much that may be, before the resistance, due to the minimum quantity, will be reached. The effect of the arrangement on unequally filled branch pipes of a main pipe is, therefore, simply that the one most full begins to discharge the soonest, and so on, every other following according to the quantity of its contents, the one having the smallest quantity beginning to discharge last.

When, however, all the branch pipes have discharged their surplus, their contents are reduced to the minimum necessary for just filling the vertical riser and no more. Then and not before is it that the resistance in all becomes exactly equal, that is, has reached the maximum; the action on all becoming then alike. Now, this is, so to speak, the strong point of the arrangement, for when in each pipe the minimum quantity is reached, no more fluid is discharged. The air rushes through and leaves that minimum quantity behind, filling the riser and forming a prop or liquid trap, which, when the next emptying process takes place, keeps the vacuum from being entirely destroyed through undue admittance of air. Each branch pipe is thus automatically provided with the material which insures the regular discharge of the surplus quantities of all the others, without having to use any valves or other mechanical contrivances for the purpose. Nor is there any danger that such a quantity can be diminished by evaporation. The bends in the pipes make it impossible that moisture in the shape of vapor should escape. The only thing required to set any branch pipe at work when it is once joined on to a main, is to throw a little water in it, just sufficient to fill the riser, and its proper operation can then be forever afterwards implicitly relied upon.

With reference to this arrangement we may repeat that the keeping small quantities of fæcal matters in the risers of the pipes, for the purposes mentioned, neither gives offense, nor changes the character of the fæcal matter; as there is no contact with the outer air, there can be no more putrefection or fermentation going on than in the air tight sealed tin vessels which are used for preserving meat, etc.

In fact, the arrangement is, in whatever light it is looked at, absolutely perfect; and when one compares the great many difficulties and intricacies of the problem embraced, one cannot but admire the simple, effective, and elegant manner in which Captain Liernur has solved it.

We next come to the improved closets Captain Liernur employs. He does not allow the water-closet at present in use by us to be connected with his pneumatic system, urging as a reason for this its sanitary, æsthetic, technical, and social imperfections, which in many cases we cannot but admit. There is a great quantity of water used, but it generally lies at such a low level that the excreta obtains in falling a momentum causing it to fall through the water and often to adhere to the basin, besides frequently wetting the person who uses the closet, owing to the

water splashing up. Then it requires for its action the turning or lifting of some handle, which many persons forget, thus entailing upon the next user a disagreeable task. Finally, its mechanism is too delicate, making frequent repairs unavoidable. This getting out of order, apart from the cost it entails, is an abominable nuisance, which once and for all excludes from the use of the water-closet about two thirds of the population of a town, namely, the working classes.

To supply these deficiencies Captain Liernur provides for his pneumatic system two kinds of privy arrangements, namely, a water-closet for those who imagine that they cannot do without such a convenience, and are willing to pay its cost; and the so-called pneumatic privy for the poorer classes, the latter being in his judgment not only cheaper, but sanitarily the more perfect.

The chief feature of the water-closet consists in the basin being a sort of chamberpot, placed so close under the opening in the seat, that the surface of the water is no further from the body of the person than it would be if he really used such a utensil. This basin turns on one side on a hinge, being held horizontally ready for service so long as a person is in the closet apartment, and tilts and empties itself in a syphon below, the moment he has left. This motion is obtained by the weight of the person, pressing down floor and seat at the same time; the length of the stroke being only half an inch. The moment he enters the basin is lifted in a horizontal position, the water, which is now only one quart, neither more nor less, is poured in. This quantity is sufficient for the purpose. The excreta does not fall now from a height, but glides into the water, and is kept floating without soiling the sides of the basin. The chief merit of this combination is, that one quart of water only is used, and that its application and the discharge of the excreta afterwards in the soil pipe below, occurs automatically and independently of the will of the user of the closet.

The pneumatic privy has no movable mechanism at all, and is used without any water for flushing. The excreta falls into the bottom of a deep funnel, but the size and position of the seat opening is so arranged, and the shape of the funnel is so made, that the extreme area in which the excreta can fall is practically as much limited as would be the case in an ordinary chamberpot. The effect is that the excreta falls and is collected in a pocket below of but small compass, without touching the sides of the funnel, offering to the air a surface of only five inches. The pocket referred to is one arm of a short bent tube or syphon trap, discharging in a soil pipe. This discharge is effected by the weight of the excreta, fluids and solids, themselves, each new deposit forcing the former out. Thus the older matter is automatically shut off from further communication with the outer air, and it being well known that no fermentation capable of generating elements dangerous to health takes place within the first thirty hours after production, it is evident that the small surface of fresh substances exposed to the air could at the utmost only throw off offensive gases. To carry these off, however, each funnel is ventilated by a two-inch pipe placed close under the seat and leading to the outside of the roof of the house, and furnished on top with a so-called Wolpert's air-sucker. This little contrivance, scarcely known in this country, is very simple, having no movable parts whatever, but is singularly effective; the slightest and almost imperceptible motion of air (which in towns is never quite still) causes an upward current in the pipe, provided the difference of temperature between the outer air and the air of the apartment is not too great. To prevent this

occurring, the window of the apartment is made so that the outer air can always communicate with the air within.

The result is that when the lid is removed from the seat-opening a current of air strikes at once downwards into the funnel. From this it is evident that under no circumstances can an offensive smell escape from the funnel into the apartment. The funnel itself being of a dark color, throws no reflected light on the excreta below. It is plain, therefore, that there can be nothing to offend either the sense of sight or the sense of smell; and this is all that can be expected from the best water-closet.

This is now established by experience. The various official reports of impartial judges are conclusive on the subject. Among many, we may especially mention that of the Medical Inspector of Holland, Dr. Egeling, who states that all the Medical Inspectors of the Netherlands are unanimous in this respect. Further, the report of the President of the Medical College of Saxony, to the Minister of the Interior of that Kingdom; also that of the Director General of the late Vienna Exhibition (where these closets were in use during the whole time it was open); and the reports of a great many commissioners of towns, which all agree in confirming. Practically, the most favorable testimony of all consists in the fact of the satisfaction these closets give in all places where the plans of Captain Liernur have been strictly followed.

The Chief Engineer and Director of Public Works of Amsterdam, where Captain Liernur's system has been adopted in spite of strenuous opposition, and universally commended, submitted a report in July of this year to the Common Council, calling the Liernur system absolute perfection in a technical and sanitary sense, and recommended its extension to the whole of the new town and the most populous part of the old; and in like favorable manner the Chief Clerk of the Public Works expressed himself in a series of answers to questions put to him on the subject, which were published in the London journal, *Engineering*, of August twenty-eighth of this year, and which gives an idea of the opposition made.

With the same view of enabling our readers to obtain correct information, we advise those who wish to see the working of the system to go to Leyden, where it has been in operation for over three years in a few streets, by way of trial. The works there, although executed after Captain Liernur's earlier plans, since which many improvements have been effected, has given such unbounded satisfaction that last month the principal citizens (among whom were the entire Faculty of the University), petitioned the Common Council to apply the system forthwith to the whole town; and the Committee for Finances have recommended since then that Captain Liernur be charged with preparing plans for that purpose.

In Rotterdam and Dordrecht, the commissions who were appointed to report on the subject have also recommended this system for application to the whole of these towns, basing their recommendation on the good results obtained in Leyden and Amsterdam, and in Dordrecht the works are now already in process of execution.

Before leaving the subject of Captain Liernur's closets, attention must be called to the fact, that the pocket into which the overflow of the privy funnel proper takes place is also ventilated. This pocket, being a bended tube discharging into the branch-pipe, is the real receptacle from which the fæcal matter is permanently removed; all the same, whether it belongs to the water-closet or the pneumatic privy of the

system. The pipe provided for the ventilation alluded to, serves at the same time for admitting the atmospheric air for the pneumatic process. Hence such air does not enter through the seat opening. We mention this here to set at rest the idle tales which the enthusiasts of our present water-closet system have started on this subject. The ventilation pipe in question is furnished, in its upper part, with a charcoal filter, for the purpose of deodorizing any gases which might increase the tension of the air enough to allow it to escape, and the deodorizing power of that charcoal is daily revivified through the violent downward current due to the pneumatic process.

It will thus be seen that, both in his water closets and in his privies without water, Captain Liernur has provided for every contingency.

The above account of the system would be incomplete without a description of Captain Liernur's method for making *poudrette* from the substances he collects by the pneumatic pipes.

First, a few words as to the substances themselves. We stated that they consist of all the putrescible matters of households, namely: the usual contents of the privy closets, with their contingent of chamber slops (urine and wash water), which generally find their way into them, and the sedimentary matters of the kitchen sinks, consisting principally of the fragments of waste food, washed from dishes and cooking utensils. We omitted, however, to mention the proportional quantities of each of these refuse matters. This is necessary in order to understand the practicability of the method now in question.

At first sight, it might appear that the admission of wash water in the chamber slops, of sediments of the kitchen sinks, and of water-closets for the wealthier classes, would cause such a considerable dilution of the privy matters proper as to form an impediment to the profitable manufacture of *poudrette* by distillation. It is easy to show that this is not the case.

As regards the wash-water of sleeping rooms, the proportion of the total quantity of a town to be dealt with is much less than many will suppose. The bulk of the population is made up of the working classes, and their sleeping-rooms seldom contain the toilet requisites of their wealthier fellow citizens, namely: wash basins, chamberpots, and slop pails. As a rule, the families of small tradesmen and laborers perform their ablutions in one basin common to all, and placed near the water-tap. The water, after being used, is usually thrown into the sink under such tap, while the privy receives the urine of the family direct. Each liquid flows directly to the place where it belongs; few would think of going to the privy to throw away wash-water, or to the sink for disposing of urine. The families having slop-pails, chamberpots, and wash-basins in sleeping-rooms for each member of the household, comprise at the utmost but one sixth of the population. Assuming this to be the case, and supposing that each member of such families used three quarts or one hundred and twenty ounces of water for his morning ablutions (for only the sleeping room quota is here the question), then the average dilution of fæcal matters from this source per inhabitant for the whole town would be only twenty ounces per day.

This dilution is, however, amply made up for by the sediment of the kitchen sinks, containing nearly all alimentary and fatty matter used in a household, which has not been consumed as food, and obtained an excretal form. As an average per day per inhabitant for the whole town, the weight of the urine, fæces, and kitchen-stuffs may be reckoned together at one kilogramme, or forty ounces, of which about four ounces

belongs to the sink refuse, having the form of a slush made up of small fragments coated in fat, mixed with pappy water.

That it is obtained in this form, and not more diluted, is due to the exceedingly ingenious apparatus Captain Liernur employs for separating it from the household water running off to the common sewer. It is a trap placed at some suitable spot in the open air, into which all kitchen and household water discharges. In order to flow off into the sewer, all this water must pass upward through a close grating, which acts as a strainer. The sediment is thus thrown down into a sort of pocket, which stands in communication with the privy-soil pipe. When now the pneumatic blast takes place, the pocket of the sink is cleaned simultaneously with the closet-pipes; the air to do this, which enters through the grating, blows it clean at the same time. It may be mentioned here that this trap is open to the air outside the house; all direct air-communication between the sewer and the house is thus cut off. Captain Liernur has thus practically forestalled the very valuable suggestions, with a like aim, which, under the signature of "M. D.," appeared lately in the *Times*, and were so much approved.

It must be remembered that the substances collected in the trap are chiefly unconsumed particles of food, the putrefaction of which at any rate does not take place within the first few days; until such is the case they cannot impart to the water charged with them much organic matter in solution. Hence it is evident that the prompt separation and removal which Captain Liernur effects keeps the effluent water which runs off to the sewer practically clean from polluting organic matter, and does not in either case impart to the sewage any elements capable of breeding disease by generation of gases or germs. Whatever may be the nature of that water, there is no question that Captain Liernur adds by his separation a valuable contingent to the manurial substances he collects, since in weight it amounts to almost as much as the solid excrements produced, and is nearly all composed of the same substances.

The aggregate of the matter collected, with the proportion of slops above alluded to, is equal to about sixty ounces per average inhabitant per day. Of this ninety per cent, or fifty-four ounces, is simply water.

The method followed by Captain Liernur, to convert the matter into a dry powder, consists in separating this ninety per cent of water from the solids by evaporation or distillation. He avoids the error of those who seem to think they can precipitate organic matter in solution, which is a sheer impossibility. The source of heat employed for the purpose of distillation he finds in the waste steam of the air-pump engine which collects the matter. To understand the possibility of this, it must be remembered that in few steam engines is there more than seven per cent of heat which the steam takes up in the boiler, converted into motive power, and fully ninety-three per cent escapes in the exhausted steam.

The heat in question is called latent heat, which is measured in physics by caloric units, one such unit being the amount of heat employed to increase the temperature of one pound of water or steam by 1° Fahrenheit. So long as steam retains the form of steam, the amount of calorics necessary for its existence is contained in it, otherwise it would not be steam at all; and this is the case with the waste steam of a high-pressure engine. The amount of caloric depends, of course, upon the degree of sensible heat of the steam, and upon the number of pounds of steam there is at one's disposal. It is, in fact, this sensible heat which has been diminished in giving off work. Thus one pound of steam of ninety pounds per square inch pressure contains 1,179·7 calorics, with a

sensible heat of 320·5° Fahrenheit. After escaping from the cylinder, however, it will be cooled off to about 212°, but will contain 1,700 calorics, which can be given off to any substance the steam comes in contact with.

A sensible heat of 212° Fahrenheit is, however, too low for evaporating purposes, unless under a much diminished pressure. Captain Liernur, therefore, follows the example of sugar manufacturers in applying that heat to the fluid to be evaporated in combination with a partial vacuum; and as the vapor arising from such a boiling contains still a considerable amount of heat, measurable in calorics, he uses it for a second evaporation process. The practicability of this may be understood at once, when it is considered that a fluid may be set boiling with the steam of another fluid, and this may be repeated. Sugar manufacturers call this process a double effect, or a triple effect, the last being when the vapor of a second boiling is used for a third.

To economise still further the exhaust steam of the air-pump engine, it is conducted through coils of pipes placed in the flue through which the hot gases and smoke from the boiler pass to the chimney. Its sensible heat, as experience shows, is increased by this process to about 230° Fahrenheit, and the supernatent moisture transformed again to dry steam. The whole becomes thus practically dry steam, containing about 1,152 calorics in the pound.

This dry steam, of 230°, is now conducted through coils of copper pipes placed in an upright hermetically closed boiler. Into this, about midway in height, the fæcal matter is admitted, after having been mixed with one per cent in weight of sulphuric acid, to prevent the formation of ammonia during the evaporating process. The admission takes place continuously, and the matter is continuously withdrawn from the bottom, it then having lost about half of the water it contained. This loss is occasioned by the evaporation, due to the heat of the steam of 230° circulating in the coil of pipes, and due to the fact that the vapors are carried off to a condenser, thus producing a vacuum of twenty-five inches mercury, under which reduced pressure the boiling point is reached at as low a temperature as 203°.

This condenser is formed by the second apparatus. It principally consists of a horizontal copper cylinder, revolving on its own axis during the time that it receives the vapors of the first apparatus, and is suspended in a shallow trough, into which the already thickened or reduced matter from the first apparatus flows. In rotating, it becomes on the outside covered with a thin layer of that substance. This thin layer is hence heated nearly to the degree which the vapors of the first apparatus impart to the inside of the second. But this cylinder itself is housed in a hermetically-closed vessel, which stands in connection with the air-pump engine. By means of an ordinary cold-water spray condenser, the pressure within the vessel is kept down to about 13.6 inches mercury, under which the boiling point is reached as low as 175° Fahrenheit. Under the combined effect of this degree of vacuum, and the heat imparted at 203°, the final evaporation of the thin layer in question takes place extremely rapidly, and it becomes a crust, baked on the outside of the revolving cylinder. A stationary slanting knife (or *docteur*), placed underneath, meets the cylinder in its turning round, and scrapes this crust off in the form of small flakes or shavings, which, without any further manipulation, is the *poudrette* wished for. It falls in a box placed on rollers within the apparatus, which is opened in the

evening. The *poudrette* can then be taken out and put in bags for transport to manure markets, like guano.

The whole apparatus is, from a technical point of view, exceedingly simple and effective, Captain Liernur having in the details taken care to employ only mechanical combinations which have stood the test of practice in similar contrivances. The chief merit, however, of the process, is the absolute certainty that all manurial elements, organic or mineral, are recovered in the substance obtained. As nothing can escape into the air in the shape of gases or vapors, seeing that the conversion takes place *in vacuo*, it is evident that all the ingredients must be present either in the *poudrette* or in the water distilled from it. The latter is shown by analysis to be far purer than the standard of drinking water prescribed by the Local Government Board. The only conclusion, therefore, is, that practically all manurial ingredients must be contained in the *poudrette*.

It is especially necessary to draw attention to these figures, as they will form the basis of future remarks, when it becomes necessary to allude to the opposition which has been made to the plan of Captain Liernur in Amsterdam. The inventor is satisfied to rest his claims on the tangible results which have been accomplished.

An analysis by Professor Voelcker, Chemist of the Royal Agricultural Society, dated August fifteenth, eighteen hundred and seventy-four, of a sample submitted to him by Sir Philip Rose, Bart., showed it to contain:

Moisture	8.64
Organic matter (1)	62.96
Oxide of iron and alumina	3.29
Phosphoric acid	1.76
Lime	0.86
Chlorine	6.22
Sulphuric acid	6.02
Alkaline salts	8.20
Silica	2.05
	100.00

Professor Voelcker here estimates its value to the manure merchant at eight pounds and ten shillings per ton.

It is easy to deduce from this the money value of the manure produced per day and head of population. As the daily weight of *poudrette* per head is six ounces, the annual product would be over one hundred and thirty-six pounds, which at eight pounds and ten shillings per ton of two thousand two hundred and forty pounds, gives over ten shillings per head per annum.

There is little doubt as to the correctness of this value, as it agrees substantially with nearly every estimate made by acknowledged authorities who have written on the subject.

(1) Containing nitrogen 9.35, equal to ammonia 11.35.

If the objection be raised that it has never yet been practically proven that the commercial value of sewage is so high, and that therefore no reliance can be placed upon the foregoing estimate, such objection would be based upon entirely erroneous premises. It is quite true that the manurial ingredients extracted from the sewage of our present system have no such value, but this is not because the valuable ingredients were not in the sewage, but because they are in such a state of dilution that they cannot profitably be extracted. Like a few grains of gold diffused in a large mass of quartz, there is no doubt concerning the value of the gold, but a great deal as to its being enough to pay the trouble of separation. It is the same with the highly diluted sewage of our present system. There never was, and most probably there never will be, a process capable of extracting the manurial elements from it at a profit. For evaporation the dilution is too great, and precipitation involves a chemical impossibility, seeing that the most valuable ingredients (the organic matter) are in solution, and can therefore hardly be precipitated at all. The process of immediate application on land by irrigation, which was once hailed as *the* means of delivering us from our sewage trouble, has proved fully as delusive. Experience has shown that, unless under very exceptional circumstances, no farmer can afford to pay anything for manure in the ordinary form of sewage. The dilution makes the cost of bringing it to the land too heavy, and the quantity required per acre (the annual sewage of at least one hundred persons) too great for this. This is the case, no matter how enormous may be the crops to which the sewage-farm enthusiasts constantly point, as compared with those of ordinary farming. Whatever these gentlemen may say on the subject, it is doubtful whether any of them would like to erect a pumping-engine and build miles of culvert from the town to his farm in order to convey sewage to his fields all the way at his own expense, as is done in ordinary farming with the excreta of men and animals in an undiluted state. The fact is that in most cases the town has not only to furnish the sewage gratis, but has to be at the cost of pumping it up in addition, so that the farmer can distribute it conveniently; this mode of utilization becoming thus, instead of a source of profit to the town, only a matter of additional expense. To our mind, any mode of farming has very little to recommend it on the score of agricultural merit if the primary conditions for a profitable return are that the land is cheap and that the manure costs nothing, either in purchase or carriage, and such is practically the case with sewage irrigation.

These demerits might perhaps be overlooked if sewage irrigation were perfect in a sanitary sense. There are many grounds, however, for considering that it is objectionable besides the financial and agricultural ones; this question is, perhaps, foreign to the matter immediately before us, but it is quite as well that it should be glanced at in connection and comparison with Captain Liernur's system.

The advocates of irrigation claim it to be a mode of making sewage innocuous without danger to the public health; and some enthusiasts add still greater merits, holding it to be a cure for all evils, including infant mortality. Captain Liernur, however, observes, not without good reason, that there is very little to prove that the germs of zymotic diseases, contained in infected excreta and discharged into our sewers, are killed by depositing them on a soil sodden with putrid matter. Such, he says, may perhaps be the case, if they then happen to come in contact with the stems of plants having the faculty of absorbing organisms without previous decomposition. But such plants are exceptional; and in every case there are open spaces between them, which occupy by far the greatest proportion of the area of the land. Hence the germs in question, instead of being killed, have much more chance of being brought under the fostering agency of the combination of moisture, heat, air, and putrid matter, which is peculiar to the surface of all marshy soils covered by plants. So far from there being any reason to suppose that this combination tends to destroy such germs, there is a very great probability that it is genial to their vitality. The microscopic examinations of the uppercrust of the Dantzig irrigation-fields by Dr. Niedner, of Dresden, goes far to confirm this hypothesis. That naturalist found it to be a living mass of bacteria and vibriones, to such an extent that they formed the substance which kept the particles of sand adhering together. Now, if these organisms flourish under such circumstances, why should such not take place with the germ or whatever it may be, of cholera, typhoid, etc., discharged from the intestines of sufferers by these diseases? That the immediate neighborhood of such fields is healthy proves nothing to the contrary. According to Captain Liernur it proves equally well that the germs in question, after being taken up in the atmosphere, were carried elsewhere. The possibility of their being thus conveyed can hardly be denied. He deems it demonstrated by the fact that zymotic disease often appears suddenly in places far removed from where it is raging, without traceable or possible contact with persons or objects from the infected spot. He does not doubt that germs of disease can be spontaneously generated; their very existence showing that this has occurred once, there is no reason why it should not occur again, and it is simply the question whether all the factors and conditions necessary to such creation are present. This, however, involves, as Captain Liernur justly remarks, equally much the necessity of none of them being missing. Seeing, now, that for this purpose there must be on hand, besides the required structural elements, a particular combination of moisture, temperature, absence of ozone, and more probably an influence of telluric origin, it is evident that there are a great many chances which can prevent the generation in question at all; small differences from the required degree of temperature, moisture, telluric peculiarities, etc., being more probably sufficient for this. The sudden appearance of zymotic disease in a place far removed from another which is suffering from that disease is hence far more likely due to an imported germ. And in case, as was supposed above and so frequently happens, there was no contact with infected persons or objects, it is evident that only the atmosphere was the carrier, and that hence such germs have the faculty of being taken up by it, and float about like any poisonous insect.

Captain Liernur, however, points to danger of infection from still another quarter in connection with sewage irrigation. It is to the fact that the plants take up but a small portion of the nitrogen contained in the immense masses of sewage with which they are flooded, and that the greater part finds its way to the subsoil in the shape of nitrites and nitrates. He considers in connection with this the other well-known fact that the germs or infectious organisms, which by sad experience we absolutely know are contained in water contaminated by sewage, are not detectable by microscopic examination, or even by chemical analysis, but only by the effects produced by them in the shape of disease, so that they necessarily must have the very minutest proportions. This being the case he reasons that there is no ground for assuming

that they or their morbific properties are destroyed by passing through the soil; but that there is, on the contrary, a very great probability that they find their way with the subsoil water into the stream at last. The only condition, under which this danger would absolutely not exist, could be, if the decomposition of these germs was effected during their passage through the soil, and their constituent elements assimilated or absorbed by it. But the decomposition in water of the organic matter of sewage is a very slow process, and the power of soils to assimilate or absorb the products of such decomposition is limited. The very fact now of the presence of the nitrates and nitrites in the subsoil water, proves that this limit is reached, so that the conclusion is almost unavoidable that in that case the minute germs referred to are present in the water at the same time.

It must be said in favor of this theory of Captain Liernur, that the River Pollution Commission take very much the same view of the matter. In their memorandum, No. 3, as to the purity of drinking water, public attention is called to the fact that water once contaminated by excrementitious matter, even in the minutest proportion, is liable to retain intensely infective properties. They warn especially against such waters, when flowing from the surface and upper strata from soils, and give as a reason for this warning that the presence of the infective matters or organisms, which in such cases is unavoidable and unpreventable, cannot be discovered by previous examination, but only by its influence on man.

The important fact that science utterly fails to detect the presence of the dangerous germs or organisms, shows what little significance, in a sanitary sense, can be attached to the clear appearance, etc., of the effluent water of sewage farms, to which the advocates of that method point with so much triumph.

It is also instructive to compare the clumsy way of treating contaminated liquid with the method adapted by Captain Liernur. The putrescible matter is, long before the period of fermentation, cut off from all contact with the atmosphere, and never sees daylight any more until it has become a harmless dry powder. This process occurs *in vacuo*, so that if there were any germs of disease in it they are by that very reason deprived of the most important factor for their vitality—namely, air. They are next submitted to the killing agency of the sulphuric acid, which Captain Liernur adds to the putrescible matter to prevent the formation of ammonia, and, finally, they are exposed to the heat of the drying process, which being 230° Fahr., effectually destroys the last principle of life.

How different from this is the process of irrigating land with the sewage containing the excreta of a town. It is then, as we have shown, unavoidable that germs of disease are imparted to the atmosphere and to the affluent water, both of these thus becoming the means of conveying these germs elsewhere; and we cannot but suspect that the frightful increase of excremental pollution diseases which have been noticed ever since we took to the system of discharging excreta into our sewers, and spreading them over marshy land and the surface of streams (such substances being specifically lighter than water), is due, among other causes, to that very method of contaminating the air we breathe and the water we drink.

In view of the great probability, as shown above, that irrigation farming is connected with great sanitary danger, and in view of the fact, that in most cases it is only a source of additional expense to towns, it is not to be wondered at that our most eminent engineers prefer to discharge the whole of the sewage at once in the sea, whenever there is any chance of doing so at all.

For this purpose they do not hesitate to construct conduits of the costliest character and of gigantic length, rather than to try to solve the problem by means of the many new complications and financial drawbacks involved in irrigation farming.

This circumstance shows not only how low an estimate the best authorities on the subject put on the irrigation process as a means of treating the sewage of our present system, but also how very hopeless of success they consider the extraction of the manurial elements at all. This is, as we have shown, exclusively due to their enormous dilution.

In Captain Liernur's system there is no such difficulty. His *poudrette* is not made from sewage (solids or fluids), such as we know them, but from fæcal matter and kitchen waste, diluted at the utmost with a quantity of water equal to the weight of these substances.

Then again, the process of obtaining the *poudrette*, without any loss of organic matter, is not an impossibility, such as is the case with precipitation processes, but is eminently practical. It consists in distillation, which in his method means only the evaporation of a limited quantity of water. And, finally, the cost of the process is nothing, or but very little more, than that of collecting the raw material, this collection itself being accomplished by the cheapest agencies we have—namely, air and steam.

Compared with the sewage of our present system, when considered as a manure, the *poudrette* has, however, still other advantages.

The diluted liquid sewage is too bulky to be applied anywhere but in the vicinity of the town which produces it; it can be applied to nothing but irrigation fields, and it must be applied whenever it is received, in rain or in sunshine, in season or out of season, and in whatever degree of concentration or dilution it happens to be, unless, indeed, the farmer has the power of pouring what he does not want into the next stream. These are, we think, sufficient reasons why the farmer cannot afford to pay anything worth mentioning for sewage.

The *poudrette*, on the other hand, is constant in its constituent elements; is always in the same high degree of concentration; can be applied to any crop; and kept any length of time without spoiling. The farmer can buy it when most convenient to him, and use it when most advantageous. When in connection with this it is remembered that the substances, of which the *poudrette* is the residue, have an original average value of fully ten pounds per head per annum, being the food of man, and that this *poudrette* contains a great part of their nitrogenous and mineral elements, none of them being lost during the drying process, it is not difficult to comprehend how it is, that as long as guano is worth twelve pounds per ton, the product in question must have a value of ten shillings per head per annum.

With such a resulting income, the system becomes at once safe as a financial undertaking. In fact, it is the only system that pays for itself. This is evident when the annual value of the *poudrette* is compared with the cost of construction and annual expenses.

From the report of the Director of Public Works at Amsterdam, of this year, to the Mayor and Aldermen, on the sewage of that city, we learn that the average cost of the pneumatic system was not quite two pounds ten shillings per inhabitant; this sum paying all royalties, engi-

neering, plant, machinery, and other necessary works, including all changes in the houses.

The build of Amsterdam being substantially the same as that of our English towns, there is no reason why the cost with us should be more; but in order to be on the safe side, we will assume that it would be four pounds, though there is really no reason for this increased cost.

This sum we will apply to a population of the average density of seventy-five persons per acre, and assume the town area to be two hundred and fifty acres. The total population would then be eighteen thousand seven hundred and fifty, and the total cost of the works seventy-five thousand pounds.

It will be readily seen, therefore, that the cost of sewering a town is pro rata in accordance with the population; and the productive power of the first outlay always remains the same per head, whether the population be two thousand or twenty thousand or even one million, the first outlay being always definitely calculated from the population.

Using the figures and proportions given by Captain Liernur, the following would be the estimate of working expenses per day:

Coal.—Power of air-pump engine required, 80 indicated horse-power. Consumes, at 5 pounds per horse-power per hour, in 12 hours, 4,800 pounds coal. Of the caloric due to this there is converted into work 8 per cent, or caloric due to 384 pounds, leaving the calorics of 4,800 — 384 = 4,416 pounds, on hand for evaporating purposes. There is, however, to evaporate, 54 ounces per day, for 18,750 persons, making 63,281 pounds water, requiring, with drying apparatus, *à double effet* $\frac{63281}{12}$ = 5,273 pounds of coal, for which there is left the above 4,416. There is hence wanted 5,273 — 4,416 = 857 pounds, additionally to the 4,800 pounds of the air pump engine, making in all 4,800 + 857 = 5,657, or say 2½ tons of coal per day, which at 25*s*. per ton, gives....................................	£3	2*s*.	6*d*.
Oil....................................	0	4	0
One machinist and eleven laborers....................................	2	0	0
Administration, repairs, and sundries....................................	0	13	6
	£6		
Making per year, £6 × 365....................................	£2,190		
To this would have to be added:			
For interest on capital of £75,000 borrowed from Local Board, including redemption, at 4 per cent per annum.................................... £3,000			
For renewal fund of machinery, at 8 per cent on £3,000.................................... 240	£3,240	0	0
Total expenses....................................	£5,430	0	0

The income would be, however, the *poudrette* manure of 18,750 persons, which, at 10*s*. per head, gives annually the sum of £9,375, leaving, after deducting above expenses, nearly £4,000 annually as clear profit, after paying every charge.

Should cavilers at this estimate object that the arrangements provided by Captain Liernur for preventing the dilution of the kitchen waste and excremental matter were unable to effect this to such an extent as here assumed, and that there would be for this reason a great deal more water to evaporate than above calculated upon, it is easily shown that even if this objection were well founded such would by no means prevent the system paying all its own expenses.

Supposing, for instance, that this item were double the amount Captain Liernur calculates upon, and that thus not 63,281 pounds but 126,562 pounds of water had to be daily evaporated, the quantity of coal required would then be $\frac{126562}{12}$ = 10.546 pounds, of which the unused calorics of the engine contribute as before 4,416 pounds. There would be, hence, 10,546 — 4,416 = 6,130 pounds required, in addition to the 4,800 pounds primarily consumed by the engine, making 10,930 pounds, or 4.87 — 2.5 = 2.37 tons per day more than first calculated. This makes 865 tons per annum, which, at 25*s*. per ton, gives £1,081. This extremely unfavorable supposition, for which there is not one good ground, would therefore only result in diminishing the clear profits from £3,940 to £2,869.

Astonishing as this result may be to many (it was so to us at first), there is no doubt as to its correctness. Nothing is easier than to convince oneself of this fact, as it is not at all necessary to take any of Captain Liernur's statements, or conclusions, or calculations, for granted.

There are but three factors to be considered in the question, namely: the cost of applying the system; the number of pounds of water which can be evaporated in vacuo by one pound of coal, when using steam *à double effet;* and the commercial value of the manurial product obtained.

For the first factor we have used an official statement, based upon the result of actual executed works; and this we nearly doubled, so that there is no danger of being deceived there.

For the second factor we have the experience of every sugar manufacturer. They employ precisely the same principle of evaporation as Captain Liernur; and it is well known that they deem the evaporation of twelve to fourteen pounds of water by one pound of coal not at all an astonishing performance. Every one of our readers can ascertain this for himself.

For the third factor, the means of testing the calculations are not less within our reach. Nothing more is required than to take some fresh fæcal matter, mixed with the proper proportion of urine, and with a quantity of slush out of the kitchen sink, about equal in weight to the solid excrements used, then add about one per cent, by weight, of sulphuric acid, and to place the mixture over a slow fire in order to evaporate the water from it, taking care not to burn the matter. The product obtained can then be taken to the nearest chemist for analysis, or, in order to be quite sure, be divided among half a dozen, so as to compare the results, and these results simply submitted to a manure merchant. By this manner, in which there is not the remotest chance of deception or error, the commercial value of Captain Liernur's *poudrette* can be very easily ascertained.

This is not written without a special purpose. We know how suspi-

cious town authorities have become on the subject of the profitableness of sewage projects. Most people have so settled themselves down in the conviction that the removal of filth can never involve anything but expense that they cannot bring themselves to believe in the possibility of anything else. But what is easier for them than to write to the municipal authorities of the cities mentioned by us as having adopted the system, for a statement of the cost of its application? What is easier than to inquire of sugar manufacturers about the economy of evaporation in vacuo, and of using the vapors of one boiling for a second one? What is easier than to make the experiment alluded to in order to get a sample of the *poudrette* on which the financial estimate of the system is based?

This being the case, it is evident that in the interest of their ratepayers it is the duty of all the sanitary authorities of towns which now suffer from defective sewerage, or are in difficulties on account of stream pollution, to take these steps to inform themselves on the subject.

Towns having already sewers on the water-carriage plan need not consider the money expended on them as thrown away, for these can be used, as formerly, for the removal of filtered house slops and rain water. But, through the application of the Liernur system for the separate removal of chamber slops, all excremental matter, and the contents of kitchen traps, in fact, all putrescible matter from households, there will be an end to the pollution of the soil and of the air with matter capable of generating germs of disease, which the porosity of these sewers and their ventilating arrangements now occasion. At the same time the pollution of the stream with the putrescible matter referred to will cease, and the town receive a profit-income of about three thousand pounds sterling per twenty thousand inhabitants each year, until the debt to the local Government is paid off. The profit will then be about double that amount, and remain so for ever after.

Towns having no sewers at all, but only surface drainage for the rain water, etc., with cesspools for the excreta, are in a still more fortunate position. Nothing prevents them from adopting Captain Liernur's system in its entirety—namely, his drainage arrangement, as well as the pneumatic system. They enjoy then the additional superior sanitary results which are due to the first-named part of the system. If it be objected to this that the town has in that case to pay for a double set of conduits, we need but point to the sums quoted as being clear profit on the pneumatic works. These sums, when capitalized, would be more than sufficient to pay the cost of the rain-water sewers, as a single calculation will show; and it is evident therefrom that at the utmost in that case the question is only one of borrowing a little larger sum from the local Government Board.

Captain Liernur points to still another advantage. The enthusiasts for irrigation farming insist upon it that sewage from which the putrescible matter of households is withdrawn contains still an abundance of fertilizing properties. Some even assert that sewage only becomes the better for this kind of farming by such withdrawal. We will not discuss here whether this is true or not, but must admit the justice of Captain Liernur's remark, that if it be so the application of his system insures a twofold advantage, namely, of obtaining enormous crops at sewage farming in addition to the profits derived by the sale of *poudrette*, and of conciliating those who advocate the water-carriage plan, on account of the glories and beauties of sewage irrigation. This last advantage can hardly be overrated, for it absolutely puts an end to the

war of systems and interests, thus making it easier for towns to decide what plan to adopt.

There are very few subjects upon which the minds of public bodies are more perplexed than the great sewage question, simply because during the last few years so many nostrums have been propounded that have turned out nostrums only. Hence people are tired of inquiring, and have sunk into a lethargic state, from which it is difficult to arouse them. The matter, however, is not one merely of local, but of imperial importance; and when a system like that of Captain Liernur comes forward, not upon promises as to what it will do, but pointing to what it has done, the proof of which is easily obtainable, it is certainly the duty of the sanitary government of a country thus struggling in doubt and difficulty, and nigh to despair, upon the very question, to bring about, as much as possible, by an official inquiry, a state of public mind that will enable sanitary bodies to comply with the very laws Government has made. The effect of present legislation is to force municipal bodies into measures which in so many cases have already proved futile, at immense cost to the ratepayers. The Government appointed Commissions to examine into irrigation and the A B C process, so that a similar course in regard to the Liernur system is not against precedent. We can only add that, in our mind, the long-vexed sewage problem has at last been solved, sanitarily, technically, and financially.

THE DRAINAGE OF LONDON AND PARIS.

SEWAGE SYSTEMS OF LONDON AND PARIS.

The following article presents, in a compendious form, all the most valuable points of the present drainage systems of London and Paris, especially of that of London. The works to relieve London of her sewage matter are of a magnitude incredible to one who has not visited them. In their construction they embody the experience of generations, and only that has been adopted which has borne the crucial test of time and multiplied trial. This article, written by the gentleman whose name is appended, and who likewise furnished the drawings, was prepared in accordance with suggestions furnished by myself. As the sources whence the facts have been compiled were deemed private property, had it not been for the kind coöperation of certain friends in London, I should have failed to procure them; and hence, to accomplish the task, it has cost some personal effort. But this is a trifling consideration, should the facts here exhibited serve to enable our Pacific cities to better solve the expensive problem of their sewage.

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THE DRAINAGE OF LONDON.

Before entering into any description of the present drainage of London, it will be necessary, in order to fully comprehend the reasons for the adoption of that system, to consider the three following points:

Firstly—The general features of the London basin, or of so much of it as is drained by the London main drainage;

Secondly—The natural streams and their drainage areas;

Thirdly—The early system of artificial drainage adopted in the metropolis.

In proceeding to consider the first point, namely: "the general features of the London basin," reference may be made to Figures Nos. 1 and 2, Plan No. 2, which show general geological sections, north and south and east and west respectively, taken on the lines A B and C D, Plan No. 1. From these it will be seen that the London basin is impermeable clay, resting conformably on the chalk, beneath which the upper greensand, galt, and lower greensand are present, and these latter rest, it is generally presumed, unconformably upon the new red sandstone—the wealden, oolite, and lias being absent here.

The sections, Figs. Nos 3 and 4, show the general character of the post-tertiary and recent deposits upon the general clay base of the London basin. They are silicious iron-stained gravels, sands, silt, and peaty deposits lying in grooves or pockets parallel to the river, about twelve to fourteen feet in thickness, but occasionally, though rarely, thirty-five feet thick. They are evidently deposited by the ever changing courses of the river and its tributaries. The gravel deposits being much the older, are found frequently in the higher districts, but they presented no difficulties in the construction of the main drainage works. Not so the sand and the peat, however, as the former was generally found charged with water, in consequence of its being deposited in the impermeable clay pockets in the lower districts, thus entailing a large outlay for pumping; the latter, on the other hand, had to be removed before the foundations of the necessary works could be laid beneath it. The natural surface of London may therefore be considered to be clay, pitted and grooved by the action of the river and its streams; and many of these inequalities are filled in with sand, gravel, peat, and silt.

In the consideration of the second point, namely: "the natural streams and their various drainage areas," it is necessary that the alterations made by modern improvements be left out, and the natural streams of the basin, *pur et simple*, be dealt with.

The London basin is drained by the River Thames, which has a course through it from west to east, the country on each side gradually rising from the river, north and south, the southern portion being the flatter of the two.

Each of the main portions, viz: the northern and the southern, was intersected by several small streams running north and south from the highlands, and emptying their contents into the river after meandering through the flatter portions of its banks. These streams, and their branches, subdivide the two main areas into minor drainage areas, and collect the drainage flowing east and west. Thus, a section taken through London, and parallel to the River Thames, would present a series of undulations, as shown in Plan No. 2, Fig. No. 4, in the depressions of which flowed the various streams, or drains, emptying into the river. Many of these undulations have utterly disappeared, but the descent from Holborn and Ludgate Hills, into the Fleet Valley, and that from Piccadilly to Knightsbridge, are very apparent to even the casual observer.

The total area drained by the London Main Drainage, with which this paper deals, is ninety-nine and a quarter square miles, extending from Hammersmith on the west, to Woolwich on the east, and from Stamford Hill on the north, to Anerly on the south. This is divided, as before mentioned, into two portions, the southern having an area of forty square miles, and the northern an area of fifty-nine and a quarter square miles.

The main valley lines, or streams draining the northern portion, were the Brook Green, Counter's Creek, Ranelagh, King's Scholar's Pond, Fleet, London Bridge or Shoreditch, Hackney Brook, River Lea, and several minor brooks and drains. The drainage having been diverted from the River Lea, the area drained by it formerly, now empties its sewage into the Hackney Brook, and others.

The collecting or drainage areas of the above are as follows:

	Square miles.
Brook Green	1
Counter's Creek	2¾
Ranelagh	5
King's Scholar's Pond	3
Fleet (anciently called Holebourne or Old Bourne).	6½
London Bridge	3
Hackney Brook	7½
Minor streams, including portion of the area formerly drained by River Lea	30½
Total	59¼

The streams of the southern portion were the River Wandle, Falcon Brook, Heath Wall, Effra, Earl, River Ravensbourne, and several minor brooks, a large area being undrained. The drainage into the Rivers Wandle and Ravensbourne having been diverted, is taken directly by the new main drains.

The drainage areas of these are as follows:

	Square miles.
Falcon Brook	3½
Heath Wall	3
Effra	8
Earl	9
Minor brooks and streams	16½
Total	40

The low-lying grounds, as for instance, at Lambeth, Chelsea, and the Isle of Dogs, etc., were unreclaimed swamps or partially drained by small creeks and ditches.

The third point for consideration is "the early system of artificial drainage adopted in the metropolis." As habitations and streets began to spread themselves over London, it became necessary to provide some system for carrying off the rainfall from the streets by other means than that of the gutter. Brick drains were consequently laid down, leading to the nearest valley line or stream, while those nearest to the river drained directly into it. The general direction of these drains, in order to obtain a fall and to intersect the valley line, was necessarily east and west, following the dip of the land. Those in the low districts were provided with sluices or flaps to keep back the tide as it rose, and so were tide-locked for many hours. As the majority of them delivered their contents at or near low water, many portions of London, but those more particularly on the south side, were subject to constant floods. The household refuse and fæcal matter were disposed of in cesspools,

the liquid portion of it percolating through the soil, and so finding its way into the streams, and thence to the river.

In consequence of the rapid spread of population in London, it was found necessary from time to time to cover in the main valley lines. Then they were inverted, and streets were often formed upon them, but the lower portions of many of them were still left open as before.

Such was the state of the London drainage previously to the year eighteen hundred and fifteen. The ground of the metropolis was honeycombed with cesspits, which saturated it with poisonous matter, giving rise to malaria of various kinds. The higher portions of the town delivered their surface drainage into the main streams, to be by them delivered to the river, while the lower portion delivered direct into the river itself, at low water, as before described.

At about the forementioned date (eighteen hundred and fifteen), an Act of Parliament was procured, making it permissible to drain household refuse, etc., into sewers, and their management was intrusted to eight separate Commissions, each of which had a well defined district under its control, five being on the northern area, and three on the southern. Each commission being independent of the other, no one system of drainage was carried out. Thus the seeds of much evil and expense were liberally sown, by the construction of every conceivable form of sewer, without any regard to the dimensions of those into which they had to deliver, and without any consideration as to the levels of those in the adjoining districts. As the inhabitants gradually availed themselves of the opportunity of draining into the sewers, by making overflows from the cesspits or drains directly into them, the open brooks, or valley streams, became very offensive, and consequently portions of many were covered in, though for many years the Ranelagh continued to discharge into the Serpentine in Hyde Park. A few years ago it was diverted from that lake. It was then found necessary to temporarily drain it to remove the putrefying mud, and to relay the bottom with clean ballast.

In the year eighteen hundred and forty-seven, in consequence of the passing of a new Act of Parliament, the eight Commissions then existing were removed, and in their stead, a Commission for the whole of London was appointed. At the same time, the drainage of houses into the sewers was made compulsory.

The new Commission introduced the system of pipe drainage, conveying the sewage from the houses direct into the brick sewers, as well as pipes of large diameter to drain the streets, instead of the brick sewers heretofore in use. The whole of the fæcal matter was, therefore, carried into the valley lines, and thence into the River Thames.

But now the evil of the badly constructed sewers of the older Commissions began to be apparent. Many of them being large, with segmental inverts and vertical sides, thus giving the least hydraulic mean depth, and with small fall, there was little or no flow in them; and the sewage remaining stagnant, decomposition rapidly set in, giving forth its poisonous gases, until the next rainfall partially cleared it away, carrying the fœtid matter reeking to the river to enlarge its sphere of destruction.

In consequence of the connection of the house-drainage with the sewers and main valley lines, it became necessary to have tide-flaps and sluices at the outlets into the river to prevent flooding the dwellings as the tide rose. The flow, under these circumstances, was not more, even in the well constructed sewers, than six hours a day, leaving eighteen

hours during which precipitation of the solid matter could take place. The introduction of water-closets, about this time, augmented rather than lessened the evil, as decomposition was found to take place much more readily in the presence of ordinary water. The cholera, in the year eighteen hundred and fifty-four, consequent on the above state of affairs, cost London over twenty thousand lives. The river had become saturated with sewage. Parliament took up the question, and, after appointing six Commissions, without any practical result, the present Metropolitan Board of Works was formed. It is a representative body, elected from the various districts and parishes of London. Mr. J. W. Bazalgette, now Sir Joseph Bazalgette, C. B., was appointed Engineer to the Board, to carry out the main drainage of London and other public works.

OBJECTS OF THE MAIN DRAINAGE SYSTEM.

The objects sought to be accomplished by the main drainage of London are as follows:

1. To keep the River Thames, in the neighborhood of London, free from sewage at all times of the tide.
2. To abolish all open ditches and cesspools, as well as defective or shallow sewers.
3. To maintain a continual and unintermitting flow in all the sewers along their whole length, with the aid of lifts where necessary, by which evils arising from pent-up sewage, viz: the generation of noxious gases, and the unavoidable formation of deposits in the sewer during its stagnation, would be avoided.
4. To construct the sewers at inclinations, so proportioned to the volume of fluid to be carried off by each that the velocity of the current should keep them clear of deposit without the need of regular periodical flushing, which experience has shown to be not only troublesome and expensive in its operation, but also very injurious to sewers and drains in which it is practiced.
5. To form the main sewers at such a depth as not only to receive the drainage of the deepest existing sewers, but to answer the purpose of main drains capable of extension towards the extremities or borders of their districts.
6. To provide a natural escape direct into the river, by the power of gravity alone, for storm waters and land floods of the covered streams, so as to prevent any needless surcharging of the intercepting sewers with harmless flood water. Also, to construct the new intercepting sewers of such sizes only as would be sufficient to take the general drainage of their districts, including ordinary rainfalls.
7. To follow existing public streets, roads, or paths, so as to avoid heavy compensation for injury to private property, wherever this could be done, without causing injurious curves or undue prolongation of the sewers and consequent loss of gradient.
8. To provide reservoirs at the outlets of the main outfall sewers so as to be enabled to discharge the sewage at the most suitable condition of the varying tide in the river.
9. To carry off as much sewage as possible to the outfalls by gravitation alone, using the aid of steam-power for lifting the residue.

The foregoing objects have been carefully held in view, and have been practically carried out by the Metropolitan Board of Works.

From the description before given of the relative positions of the main valley lines and subsidiary drains, it will be seen that a series of

main drains laid parallel to the river would intersect the valley lines at right angles, and by being placed at varying levels as the elevation of the land increased, could be made to collect all the drainage of the districts above them, which could then be carried to the desired locality. Such is the scheme adopted.

For each of the main areas, namely: that on the north side of the river, and that on the south, similar systems of drainage are adopted. Three trunk lines, with various branches, are in each case laid down to take the sewage and ordinary rainfall, forming High, Middle, and Low Level Sewers, as shown on Plan No. 3, and receiving the drainage of the districts indicated by their names. The storm waters are, by means of overflow weirs, discharged into or dammed into the old main valley lines, and allowed to flow into the river.

In order to satisfactorily carry out this system, it was necessary to ascertain:

First—To what distance below London it was expedient to carry the sewage to be discharged into the river, in order that it might not be carried back with the flowing tides, and also at what state of the tide it was most desirable to discharge it?

Second—What is the minimum fall that should be given to the intercepting sewers?

Third—What is the maximum quantity of sewage to be carried away at any given time?

Fourth—What is the quantity of rainfall to be carried off by them?

Fifth—What dimensions should be given to them?

Sixth—What pumping power would be required, and the description of engine to be used?

Seventh—What storage would be necessary in the reservoirs?

Each of the above questions involved a considerable amount of study and experiment, and satisfactory conclusions were only arrived at after considerable labor on the part of those engaged in the research, though they were assisted by the most eminent engineers of the day.

Upon the first two points, viz: "to what distance below London it was necessary to carry the sewage," and "what should be the minimum fall given to the intercepting sewers," very much depended. As the farther down the river it was determined to go, or the greater the fall required in the sewers, the smaller would be the area which could be drained without the employment of pumping power; but it was incumbent at the same time to go such a distance as would admit of no probability of the return of any of the sewage to the inhabited portions of the town.

In order to fix upon the position of the outfalls, and the time at which the sewage should be discharged, numerous experiments were made with floats placed in the river at various times of the tides, until at a point near Barking Creek, fourteen miles below London Bridge, where the northern outfall is now situated, the following experiment was made, and recorded in a report by the late Mr. Robert Stephenson and Sir William Cubitt, in eighteen hundred and fifty-four:

"On the thirteenth of July, eighteen hundred and fifty-one, a float was put into the center of the river opposite Barking Creek two hours after high water. This time was chosen because it was found that sewage discharged into the river two hours before high water arrived at about the same point above Barking Creek as sewage discharged two hours after high water did by the next flood tide. At low water the

float reached eleven and three quarter miles below that point, and returned with the next flood tide to one mile above it, having gone twelve and three quarter miles that flood, it being then the period of Spring tides.

"As the neaps came on, the float continued to work lower down at each succeeding high water, and by the twenty-fourth of July it was thirteen miles below Barking Creek at high water, having gone down the river fourteen miles during the falling off of spring tides to neap tides. As the floods again became stronger, it worked up the river each succeeding tide until the twenty-ninth of July, when it again came within five miles below Barking Creek at high water, having worked up the river nine miles from high water neap tides to high water spring tides, the excess of the ebbs over the floods being only five miles in fourteen days.

"Another experiment was tried at the same place on the sixteenth of August, eighteen hundred and fifty-one, it being then lowest neaps, and the float being put down two hours after high water. It worked up each succeeding high water till top springs on the twelfth of August, when it reached six and one quarter miles above Barking Creek at high water. The float then again worked down the river, till the twentieth of August, nine and one half miles below Barking Creek, being a distance of sixteen miles during the falling off of spring tides to neap tides. The excess of ebbs over the floods would in this case have been about seven miles in fourteen days. The wind and other causes would vary the result, but it may be roughly assumed that a substance in suspension works up the river about one mile a day at each high water, as the springs strengthen, and down the river two miles a day as they fall off."

From the above and other collateral evidence it was determined that Barking was the most suitable point for discharge, as the sewage would in no case be carried nearer than about seven or eight miles of London; and that the discharge should take place as soon after high water as was practicable, as it was found that the discharge at high water, at any point, was equivalent to a discharge at low water twelve miles lower down. On this account such districts as have levels that would permit of their sewage being intercepted and carried to Barking by gravitation, in order to deliver it at or about high water, are drained into the Northern High and Middle Level Sewers.

The point selected for the southern outfall is about two miles lower down than Barking on the other side of the river—namely, Cross Ness Point. The levels of the southern district differ from those of the northern in that they do not allow of the sewage being discharged by gravitation at high water, but only at low water in cases of emergency. The whole of the sewage, therefore, is in the ordinary course, lifted to the required level at the outlet.

With regard to the necessary fall to be given to the sewers; the velocity of flow required to keep them free from deposit had first to be determined.

It was ascertained by experiments that in a half filled sewer, taking the bottom velocity, various substances are carried away, as shown in the accompanying table:

Velocity in sewer bottom in inches per second......	Miles per hour...	Substance removed or carried away.
3	....	Fine clay (worked up).
6	....	Fine sand (removed).
8	....	Coarse sand (removed).
12	....	Small gravel (removed).
16	$\frac{9}{10}$	Pieces of brick and stone (removed).
22	$1\frac{1}{4}$	Iron borings and slag (removed).
24	$1\frac{1}{2}$	Heavy gravel, and stones 1 in. diam. (carried away).
36	$2\frac{1}{22}$	Stones as large as hen's eggs (carried away).

From examination of the above a minimum bottom velocity of one and a half miles per hour was considered sufficient to remove any substances likely to find their way into the intercepting sewers, and was, therefore, decided upon.

Having determined the necessary velocity, the quantity to be carried off had to be next ascertained, and, from these data, the form and fall of the sewers were then calculated so as to produce the required velocity.

London is now completely supplied with water closets, no cesspits of any kind being permitted to be constructed, and these, together with the sinks, etc., are connected with the sewers, so that almost the whole water supply finds its way into them. The sewage to be intercepted was found to be equal to the water supply, as such quantity as was lost by evaporation or waste was compensated for by leakage into the drains.

The average number of the population of the denser portion of London is thirty thousand people per square mile, and that of the outlying districts, which are wholly built upon, is twenty thousand per square mile. The water supply was taken at five cubic feet or thirty-one and a quarter gallons per head of the population per day, being an excess of about ten gallons per head per day over the actual supply at the time the observations were made, so as to leave a fair margin in case of any increase. A slight augmentation has taken place, but only of two or three gallons per head.

The amount of sewage to be intercepted in any given district was thus easily calculated. For instance, the Fleet Sewer, draining a district the area of which is $6\frac{3}{8}$ square miles, with a population of average density, would deliver about nine hundred and fifty thousand cubic feet or five millions seven hundred thousand gallons of sewage per day.

It was observed that the flow of the sewage was not uniform, in consequence of which a considerable staff had to be employed for a long period to gauge the flow over large districts. By this means not only was the sewage flow ascertained, but the effects and quantity of ordinary rainfall and floods were also made known.

From these observations it was established that one half of the ordi-

nary daily sewage of the metropolis passes in from six to eight hours, and between nine o'clock A. M., and five o'clock P. M. Provision was therefore made for the maximum case, namely: one half the flow in six hours, leaving a large margin to meet any extraordinarily rapid flow that might take place. To this had to be added the rainfall, and this question evoked much scientific discussion. While it was maintained by some that the whole of the rainfall should be taken by the intercepting sewers, by others it was held that the rainfall should be dealt with separately. But the objections to both of these schemes were many and well founded.

If the whole of the rainfall had to be intercepted, provision must have been made for storms, during some of which as much as two inches fall in an hour over nearly the whole of London. Sewers capable of taking so enormous a quantity, in addittion to the ordinary sewage, would be very costly, and for nearly the entire year would be carrying only a shallow stream of sewage in the bottom, and would consequently require a much greater fall to keep the solid matter in motion. Enormous pumping power would also have to be provided to meet such cases of flood, but which would stand idle for nearly the whole of the year.

Much may be said in favor of the scheme for separating the rainfall from the sewage by a distinct series of drains, and, in the case of draining an undrained town, it would no doubt be the best system to adopt, as the rain-water drains might be built over the sewers. But in the case of London, which had its street and main valley lines already constructed, it would have been almost impracticable, as it would have entailed the redraining of the whole town at a cost too great to be contemplated. Consequently, "Object No. 6," to provide only for the sewage and ordinary rainfall, as previously enumerated, was strictly borne in mind in the carrying out of the new sewer works.

In determining the amount of rainfall to be intercepted, it was ascertained that rain falls in London on about one hundred and fifty-five days during the year, and of these there are only twenty-five on which the fall exceeds one quarter of an inch, or at the rate of one hundredth part of an inch per hour for twenty-four hours. A large portion of such falls is evaporated and never reaches the sewers, as it was found, from the observations and gaugings before alluded to, that from a rainfall of one quarter of an inch only one eighth of an inch reached the sewers; from four tenths of an inch only one quarter inch reached them, and often sensible amounts of rain fell without adding in any perceivable manner to the sewage. The amount of rainfall which it was, therefore, decided to intercept, or carry away in the intercepting sewers, is one one hundredth of an inch per hour, equal, if taken over a whole day, to a fall of one quarter of an inch in a day. This quantity, being equal in volume to the maximum sewage flow during any similar period of the six hours mentioned, would occupy an equal space in a sewer, but during the remaining eighteen hours of the day, the sewage having decreased in quantity, additional space would be left to carry off any rainfall, should it be necessary. Consequently, a sewer capable of carrying off twice the maximum sewage flow, with the safety margins already mentioned, was adopted throughout the main drainage system.

As only from fifty to sixty per cent of the actual rainfall ever reaches the sewers, they are, therefore, capable of taking an absolute fall of from three fifths of an inch to one half an inch in a day, and there are not more than about twelve days in the year on which the fall is in excess of this. The ramifications of the feeders or street sewers, and their

varying distances from the intercepting lines, allow a large quantity of the rainfall, in the districts immediately surrounding the latter, to pass off before that from the neighborhoods comparatively close reaches them; thus, as it were, spreading a given rainfall over a period considerably in excess of that in which it actually takes place.

Having decided the necessary velocity to be given to the sewage, and the amount to be carried away, the minimum fall of two feet per mile and the various increasing areas to be given to the sewers as each main line was tapped, were easily calculated from some of the most authoritative formulas.

The form of sewer adopted is circular or segmental, when the flow is large, and egg-shape for the smaller branches, which gives the greatest hydraulic mean depth for the dry weather flow.

At the junction of the valley lines or main sewers with the intercepting sewers, or at some other convenient point in their course, weirs are formed, over which any storm water is allowed to flow when it exceeds that quantity which each district drained by such main sewer should contribute. This storm water then passes into its natural channel, or old sewer, and is discharged into the river direct, thus preventing the overcharging of the intercepting sewers. By the time the water has risen to the level of the weirs the sewer itself has, as a consequence, been well flushed by the extra storm water, and all the flushings have been carried into the intercepting sewer. Therefore, such of the remainder as may flow over the weir into the river can contain little or no sewage matter. The valley lines and main sewers are, as has been previously explained, simply the two old ditches and watercourses straightened and covered in. They are, consequently, of ample area to convey the largest storm flood to the river, as they were not reduced in dimensions before being covered in.

The dimensions of the existing outlets of some of the principal valley lines are as follows:

Counter's Creek—Nine feet six inches by nine feet.
Ranelagh—Nine feet by nine feet.
King's Scholar's Pond—Thirteen feet by twenty feet.
Fleet—Fourteen feet by twelve feet.
Regent Street—Six feet six inches by five feet.
Hackney Brook—Six feet in diameter.
Falcon Brook—Eight feet by eight feet.
Heath Wall—Nine feet by nine feet.
Effra—Fourteen feet six inches by ten feet.
Earl—Ten feet in diameter.

The class of engine decided upon as the most advantageous and economical under the required conditions of comparatively small and varying lift, is the condensing double-acting rotative beam engine, working solid plunger or force pumps, directly from the beam.

DETAILS OF THE MAIN DRAINAGE SCHEME.

The northern and southern divisions of the metropolis differ considerably in their levels and physical aspect. Consequently, although the same general drainage system is carried out in both, yet there is a large amount of diversity in many of their features. The main object has been to remove as much of the sewage as possible by gravitation. To this end the northern division is divided into four drainage areas—the

High, Middle, Low, and Western Districts. The High and Middle Districts include all that area which can be drained by gravitation alone and delivered at about high water level at the outfall. The high and middle level sewers and branches performing this duty are shown on Plan No. 3, and forming a junction at Old Ford, are continued in the northern outfall sewer down to Barking.

The Low District includes all that area which can be drained by pumping the sewage a height of thirty-six feet into the northern outfall at Abbey Mills. This is performed by the low level sewer and branches and the Abbey Mills pumping engines.

The Western District includes all that which can be drained by pumping the sewage a height of eighteen feet into the low level sewer at Pimlico. This is done by the Western District sewers and Western Pumping Station; and the sewage, after flowing by gravitation down the low level sewer to Abbey Mills, is there again lifted into the northern outfall sewer, together with that of the Low Level District. The northern outfall sewer takes the whole of the northern sewage by gravitation to the reservoirs at Barking, where it can be discharged at the proper time of the tide.

The Southern Division consists of three drainage areas—the High, Middle, and Low. The High and Middle Districts include all that area which can be drained by gravitation alone, and delivered at or about low water level at the outfall. This is done by the high level and Effra branch sewers (corresponding to the high and middle level sewers of the Northern Division), which join at Deptford and flow into the southern outfall sewer at that point.

The Low District includes all areas which can be drained by pumping the sewage a height of eighteen feet, at Deptford, into the southern outfall sewer. This is performed by the low level sewer and branches and the Deptford Pumping Station.

The southern outfall sewer takes the whole of the southern sewage by gravitation from Deptford to the pump well at Cross Ness Pumping Station, where it is lifted into the reservoirs, to be discharged into the river at the proper time of the tide.

The following table shows the areas of each of the districts drained by the main lines and branches, and also their ruling gradients, dimensions, etc.:

TABLE, SHOWING—

NAME OF DISTRICT, OR SEWER LINE.	Drainage area in square miles.	Fall of sewer.	Shape of sewer	Dimensions from commencement. Feet.	Dimensions at termination. Feet.	Length in miles
Northern Division.						
High level	9¾	1 in 71 to 5 ft. per mile at lower end.	Circular.	4 feet.	9.6x12.0	7
Middle level			Segmental.			
		17½ ft. per mile to 2 ft. per mile at lower end.	Egg shape.	4.6x3.0		
	17¾		Circular.	10.6		9½
			Segmental.		9.6x12.0	
Piccadilly Branch		4 ft. per mile.	Egg shape.	4.0x2.6	4.0x2.6	2
Low level	11	3 ft. to 2 ft. per mile.	Circular.	6.9	10.3	
Branches						8¼
Western division and low level extension						4
Chiswick sewer		2 ft. per mile.	Circular.	6.9	6.9	1½
	21	4 ft. per mile.	Egg shape.	4.0x2.8		3¼
Branch sewer			Circular.		4.6	
Acton Branch		10⅓ ft. per mile.	Egg shape.	3.9x2.6	4.6x3.0	1
		4 ft. per mile.	Egg shape.	3.9x2.6	4.0x2.8	1½
Outfall sewer	Above ground.	2 ft. per mile.	Segmental.	Two, 9x9	Three, 9x9	4½
Southern Division.						
High level		53 ft., 9 ft., and 2⅓ ft. pr. mile.	Egg shape.	4.6x3.0		
			Segmental.		10.6x10.6	7
Effra Branch and branches	20	30 ft. to 2⅓ ft. per mile.	Circular.	7.0x4.0		
			Segmental.	10.6x10.6	10.6x10.6	7½
Low level		4 ft. to 2 ft. per mile.	Circular.	4.0		
	20		Segmental.		Two, 7x7	10
Bermondsey Branch		4½ ft. per mile.	Circular.	5.0	5.6	2
Outfall sewer		2 ft. per mile.	Circular.	11.6	11.6	7¾

NORTHERN DIVISION.

The High Level Sewer commences by a junction with a portion of the Fleet Sewer, near Hampstead Hill, intercepting a portion of the drainage of that sewer, and that of the Hackney Brook, etc. It passes under the North London Railway, Great Northern Railway, New River, and Sir George Duckett's Canal, etc., to a junction with the Middle Level Sewer at Old Ford, where it has a storm overflow into the River Lea. The eastern portion of the district to be drained by the sewer is very low, and was drained by the River Lea and part of the Hackney Brook. It was therefore found necessary to take the sewage into the Low Level Sewer by a branch called the Hackney Wick Branch, passing beneath the Northern Outfall Sewer, near Old Ford. The thickness of the brickwork in the High Level Sewer is nine inches in two half brick rings at the upper end, to two feet three inches in six rings at the termination.

The principal works on the line are a tunnel half a mile long; tunneling under the Great Northern Railway, which is on a thirty-foot bank; under the New River, which is likewise on an embankment; also, under Sir George Duckett's Canal, where the distance between the soffit of the arch and the water in the canal is only two feet; the top of the sewer and the bottom of the canal are formed of wrought iron girders, with plate decking covered with puddle. Many houses were tunneled and underpinned, and one is carried on girders—the basement being occupied by the sewer.

The Middle Level Sewer commences at Kensal Green, intercepting the greater portion of nearly all the principal valley lines, and passing under the Paddington Canal and Great Western Railway, over the Metropolitan Railway, under the Regent's Canal and North London Railway to its junction with the High Level at Old Ford. It has a storm overflow into the Ranelagh—also, at Old Ford and other points. The Piccadilly is the most important amongst its branches.

The thickness of the brickwork is the same as that for the High Level, viz: from nine inches to two feet three inches. The principal works on the line are four miles of tunneling on the main line, and the whole of the Piccadilly Branch, the depth below the ground surface being from twenty to sixty feet; the aqueduct over the Metropolitan Railway, which is one hundred and fifty feet span, and having only a distance of two and one half inches from the invert to the regulation height above the engine chimneys. It is formed of a circular tube, constructed between two girders, which rest on rollers at one end, where an expansion joint is provided in the sewer itself to permit of the elongation or contraction of the tube under the varying conditions of the atmosphere. In consequence of the close proximity to the engine chimneys, the whole aqueduct was built on a stage considerably above the railway, and was lowered into its place by hydraulic power. The tunnel under the Regent's Canal was completed with much difficulty, the water having once burst in on the works. Coffer dams were then used to inclose one half of the canal at a time, within which the sewer was built. The greater portion of this sewer is constructed in the gravel.

At the junction of the High and Middle Level at Old Ford, before alluded to, there is a large penstock or valve chamber, and a chamber containing overflow weirs. The penstocks are five in number and are raised and lowered by machinery, by means of which the sewage arriving by the High and Middle Levels can in case of accident be diverted from the outfall sewers and allowed to flow into the River Lea. The overflow chamber is one hundred and fifty feet long by forty feet wide, and thirty feet high, divided longitudinally into two parts, in each of which is a trough nine feet deep, one being twelve feet wide and the other sixteen feet wide, having spaces about two feet six inches wide between the troughs and the chamber walls. The sewage flows into the troughs in each chamber, and then into the outfall sewer. In cases of storms, should more water be brought down than is to be taken by the outfall sewers, it rises in the troughs and flows over their edges or weirs down the spaces left for the purpose, and into a lower chamber constructed beneath the troughs which communicates with the River Lea.

The Low Level Sewer commences at the Western Pumping Station, Pimlico (its extension at a lower level to Cremorne will be taken under the head of Western Division), and passes, generally, close and parallel to the river; along the Northern or Victoria Thames Embankment; under the Metropolitan District Railway; under the Fleet Sewer outlet at Blackfriars; the North London and Great Eastern Railways, Lime House Canal, and the River Lea, to Abbey Mills Pumping Station. After receiving the drainage of the Western Division at Pimlico it intercepts the whole of the valley lines and sewers, carrying off all the sewage not previously taken by the High and Middle Level. It has storm overflow weirs at its junction with the valley lines, the principal of which is at the Fleet. It has two branches, viz: the Hackney Wick Branch and Isle of Dogs Branch. The latter drains a district which was formerly only a marshy island, but which from its position on the river was commercially of enormous value as a site for ship-building yards, docks, and wharves; but, being considerably below high-water level was undrained and almost uninhabitable. Now, however, it is well drained, and largely built upon.

The principal works connected with this sewer are nearly five miles of tunneling from Blackfriars to Bow. Along the Victoria Embankment it forms part of the river wall backing, carrying above it a subway for the gas and water mains. Close to Blackfriars Bridge the sewer passes beneath the Metropolitan District Railway and Fleet Sewer, the railway passing over the Fleet at a little distance. In order to carry this out, both the Low Level Sewer and Fleet had to be depressed at the crown and flattened out to maintain their areas. The Low Level was here formed of elliptical cast-iron tubes, stiffened with ribs, the railway being carried over it on cast-iron trough girders. The Fleet was diverted into two channels, over which the railway was carried. A large penstock chamber is here formed to govern the flow of the Fleet. There are four penstocks arranged in two tiers one above the other, with two penstocks in each tier. At the mouth or mouths of the sewer are large tide-flaps for keeping back the tide. This sewer is constructed almost entirely in the clay.

WESTERN DIVISION.

The sewer commences at Chiswick, passing under the Kensington Canal and West London Railway to a junction with the low level extension at Cremorne temporary Pumping Station. It has two branches, one to Putney Bridge, and one to Acton, which passes

under the Metropolitan Extension and West London Railways to its junction with the western sewer at Cremorne. The low level extension commences at Cremorne, and passes close to the river bank and along the Chelsea Embankment (where it is constructed similarly to that portion of the Low Level in the Victoria Embankment), to the Western Pumping Station at Pimlico. These sewers were constructed principally in the gravel which was generally surcharged with water. Sumps had to be sunk at different portions of the lines, and powerful pumping engines employed to keep the works clear of water, a stoneware pipe being laid underneath the sewer to convey the water to the nearest sump.

The Western Pumping Station, now nearly completed, will raise the drainage of the Western District (which is at present discharged into the river by the temporary pumping engines at Cremorne) a height of eighteen feet into the Low Level Sewer. The amount of sewage to be lifted is estimated at thirty-eight thousand gallons per minute. Four engines, of ninety horse-power nominal, making an aggregate of three hundred and sixty horse-power, are provided for this purpose. Three of these engines will be sufficient to effect the required work; one being spare, in case of repairs and accident. They are double acting high-pressure condensing engines, each working two single acting plunger pumps five feet three and a half inches in diameter, with four feet stroke. The engine cylinders are three feet one inch in diameter, with eight feet stroke. The beams are fifty-five inches deep at center, of box section, and of wrought iron riveted; being thirty feet in length between the centers of piston and connecting rods. The connecting rod of each engine works a crank shaft, upon which is secured a fly wheel twenty-four feet in diameter, having a twenty-ton rim. Starting gear is attached to the fly-wheel rim. The pump cases and suction tubes stand upon the foundations of the pump well. The suction and delivery valves (Porter's patent) are hinged, and mounted with leather. The delivery pipes are of cast iron, five feet in diameter, branching into a six-feet-nine-inch pipe, in which there is a six-feet-nine-inch stop valve or penstock, to prevent any back flow from the Low Level Sewer, should the engines be stopped at any time. This pipe is built into the brickwork of the Low Level Sewer, which is of the same diameter at this point. An escape or overflow pipe is provided from the top of the pump well into the river. It is closed with a penstock, and has double tide flaps at its outlet in the river wall. The water from the hot well is carried through snake pipes placed in the pump well, for the purpose of allowing the sewage water to cool it. It then flows back to a reservoir constructed beneath the coal vaults, to be used again when required. The boilers are eight in number, of six feet nine inches in diameter, with double flues each two feet in diameter, twenty-two feet long, and of the Cornish pattern. They are connected with a chimney stack one hundred and seventy-two feet in height, encased in a square tower in which is a winding staircase running round the stack to its top. The tower, at the ground line, is twenty-one feet square, tapering to fifteen feet square at the top. The foundations are carried down to the clay, and are formed of a bed of concrete twenty-five feet square.

An auxiliary engine, in a separate building, is also provided for cases of emergency. It is one hundred and twenty horse-power nominal, high pressure, and non-condensing. It is supplied by two boilers, similar to those already described. The pumps, which draw from a separate pump well, are of the bucket and plunger kind.

Before the sewage enters the main pump well, it passes through chambers containing open iron cages, or filth hoists, in which any large substances will be intercepted previous to the sewage arriving at the pumps. The cages are lifted by machinery into a covered passage or area below the surface of the ground, and in front of the engine house. Their contents are there emptied into trucks and carried away on a tram, to be disposed of as may be required. The filth hoists are in duplicate, one behind the other, so that one is lowered before the other is drawn up. Thus there is no interruption to the screening of the sewage.

The principal engine house is situated facing the river. Its length is one hundred and sixteen feet, and its height, from ground to ridge, seventy-one feet. It is in the Italian style, with a mansard roof. It is divided into three stories; the upper or beam floor being on a level with the beam centers of the engines; the ground floor being the engine floor; the floor beneath being for the purpose of providing access to the pumps and valves; and the basement being the pump well.

The boiler house is in the rear of and abutting against the engine house, but at a lower level, trams being laid from the coal vaults to the boiler house floor.

The coal vaults are at the side of the engine house, and extend to a wharf in the Grosvenor Canal. Cranes are mounted upon them for unshipping the coals and delivering them into trucks running on three tram lines, from which they can be shot down through openings into the vaults below.

In the rear of the boiler house there is a settling pond, one hundred and forty-two feet by sixty-eight feet and sixteen feet deep, divided into two compartments, in which the river water is allowed to settle before being used for the boilers.

The auxiliary engine and boiler house, stores, workshops, workmen's cottages, and trams are placed in convenient positions, in the rear of the engine house.

Abbey Mills Pumping Station is situated at the end of the Low Level Sewer, the contents of which, including that already lifted by the Western Pumping Station, have to be raised a height of thirty-six feet into the Northern Outfall Sewer. The maximum quantity of sewage and rainfall, about ninety-seven thousand gallons per minute, is lifted by eight engines, each of one hundred and forty-two horse-power—in all one thousand one hundred and thirty-six horse-power nominal. They are placed in one engine house, cruciform in plan, two engines being in each arm. They are the same kind as those described for the Western Pumping Station, but rather more powerful. The cylinders are four feet six inches in diameter, and nine feet stroke. The pumps are double acting, three feet ten inches in diameter, and four and one half feet stroke, half the lift being performed by suction, and the other half by forcing. The beams are of cast iron, seventy inches deep at the center, and thirty-seven feet six inches long between extreme centers. The fly-wheels are twenty-seven feet in diameter, with twenty-six-ton rims. The pumps deliver through cast-iron pipes and a ten-foot six-inch cast-iron culvert into the Northern Outfall Sewer. There are sixteen boilers, in two boiler houses containing eight each. They are of the Cornish pattern, eight feet in diameter, thirty feet long, with two tubes in each, three feet three inches in diameter, delivering through brick flues into

two chimney shafts, each of which are two hundred and nine feet high, and eight feet internal diameter, with foundations carried down to a depth of thirty-five feet. Trains connect the boiler house floors with the coal vaults. The engine and boiler houses are attached to each other, their extreme dimensions being one hundred and forty-two feet six inches. The width of the arms of the cross is forty-seven feet six inches. Each of the boiler houses is one hundred feet by sixty-two feet. The center of the building is covered by a dome, the total height of which is one hundred and ten feet. The style of the building is a mixed Gothic. The arrangements of the internal floors, the coal vaults, settling ponds, filth hoists, workshops, and workmen's cottages, are similar to those of the Western Pumping Station.

The Northern Outfall Sewer commences with a junction with the penstock chamber at Old Ford, as previously described. Here it receives the contents of the High and Middle Level Sewers. It consists of two brick sewers segmental in form—that is to say, a semicircular crown, with segmental sides and inverts, nine feet high by nine feet wide. It passes close under the North London Railway, which is carried over it on girders. From this point to the outfall at Barking, the level of the ground is very low, a large portion of it being under high-water level. Consequently, in order to deliver the sewage at high water, this sewer is constructed entirely above ground. It is laid upon concrete foundations carried down through the peaty soil to the gravel beneath. The culverts are entirely surrounded by concrete, which is carried up with a slope of one to one to give support to the sides of the sewers, the whole being covered with an earthern embankment, and fenced with hedge and ditch. Very many roads had to be raised or lowered to admit of the sewers passing under or over them. This entailed the purchase of a large amount of house property.

Amongst other works of importance, upon this line, are the following: (See Plan No. 5, Figures 1 and 2.) The aqueduct over the River Lea, which is of fifty-seven feet span, and consists of two wrought iron culverts, of the same section as the brick sewers, slung between three wrought iron plate girders. Upon the top a roadway is formed with proper parapets.

The bridge over Abbey Mill Lane consists of two self-supporting wrought iron tubes. The crossing over Abbey Creek, close to which the junction with the culvert bringing the contents of the Low Level Sewer from Abbey Mills takes place, consists of three cast-iron culverts, supported by four wrought-iron plate girders, in two spans of forty feet each.

THE LOWERING OF THE NORTH WOOLWICH AND BOW AND BARKING RAILWAYS.

For a considerable distance over the marshes, the peat was found to be of so great a depth that the cost of sinking a solid foundation would have been enormous. In lieu of this, pits were excavated six feet six inches wide, and of the full width of the embankment, down to the gravel beneath, at intervals of twenty-one feet from each other. These were filled in with solid concrete, so as to form piers, and upon them were turned brick arches, four rings in thickness; and upon these again were built the culverts and embankment, as before described. The inverts of these culverts are about eighteen inches below high-water mark at the outlets; but before being discharged into the river the sewage falls over an apron a depth of sixteen feet, whence it is carried

by nine six-feet culverts, laid in the river bed at the level of low-water spring tide. Penstocks are arranged above the apron so as to divert the sewage into the Northern Outfall Reservoir, as it is only discharged into the river within about two hours after high water.

The Northern Outfall Reservoir, which receives the contents of the Northern Outfall Sewers, is situated about eleven and one quarter miles below London Bridge. It is sixteen feet nine inches deep, and covers an area of about nine and one half acres. It is divided into four compartments, and completely covered in with brick arches on piers, and is capable of containing about thirty-nine million gallons. The foundations of the piers are carried down about twenty feet below the level of the floor, which is paved with York stone. The whole is covered with an embankment of earth. One side of the reservoir is formed by the outfall sewers themselves, which are here provided with sixteen openings, each having a penstock, so that the flow of sewage may be either turned into the reservoir or river direct, as required. Beneath these penstocks are sixteen other openings, with penstocks for the outflow of the sewage from the reservoirs into the river. These openings are connected with the nine six-foot culverts, before described, which deliver the sewage at the bottom of the river. In order to prevent the sewage rising above a certain level in the reservoir, overflow weirs are formed in the partition walls, which are built hollow, and communicate with the discharging culverts. The reservoirs can, however, be entirely filled, if required, by closing penstocks fitted to the discharging culverts.

A large culvert is constructed at the back of the reservoir, having communications with each of the compartments in the reservoirs—the openings being fitted with penstocks. This culvert communicates with the river, so that at high tide any of the compartments can be filled with water and be cleansed by being flushed out at low tide.

Any one or all of the compartments can be filled from the Northern Outfall Sewer, as may be required.

The river bank is protected by a coffer dam.

SOUTHERN DIVISION.

The High Level Sewer commences at Clapham, intercepting the principal valley line. It is constructed of sufficient dimensions to carry off the storm waters, which it discharges into Deptford Creek. The Effra Branch, corresponding to the Northern Middle Level, commences at Upper Norwood and intercepts the southernmost drainage of this division. It, like the High Level, is also of sufficient capacity to carry off the storm waters, which are discharged over a weir, with those of the High Level, into Deptford Creek.

As a very large area of this division is exceedingly low and flat towards the river, the lower lines would have been flooded if the storm waters from the upper district had been allowed to flow into them as is done in the Northern Division. Therefore, the High Level Sewer and Effra Branch were constructed to carry the storm waters as well as the sewage from the old sewers and valley lines to a new outlet at Deptford, as described. The sewage and a certain amount of rainfall are carried under Deptford Creek in four cast-iron culverts three feet six inches in diameter each, and delivered into the outfall sewer.

The principal works on these lines are the Dulwich Tunnel, one thousand feet in length; the double sewer along New Cross Road, which is about one thousand one hundred and thirty feet in length, each culvert

ten feet six inches by ten feet six inches, segmental in form. In excavating for these sewers a large quicksand was encountered, which caused considerable expense and delay. The method adopted of withdrawing the water without drawing of the sand was first to sink, in some convenient position near to but not in the intended works, a brick well, to a depth of five or six feet below the lowest part of the excavation. In some cases where the depth was great, an iron cylinder was sunk below the brick-work, and the bottom and sides of the well were lined with shingle, which filtered the water passing into it, and exposed a large surface of this filtering medium. Earthware pipes were carried from this well and laid below the invert of the intended sewer, small pits being formed at the mouths of these pipes to protect them from the deposit. (Plan 5, Figure 3.) By these means the water has been successfully withdrawn from the worst quicksands, and they have been rendered firm and dry for building on without any subsidence of the ground above them. Iron plates have in olden times been laid underneath the brickwork of the invert of the sewers to support them in such treacherous ground, but concrete is now wholly used, and forms both a better and a cheaper foundation, and unless the ground is so dry and solid that it can be excavated to the exact form of the sewer to be placed on it, there is no portion of the work more important than the effectual backing of the invert and the haunches with concrete.

The storm outlets to Deptford Creek consist of two ten feet six inches by ten feet six inches double tide flaps, the large lower ones being fitted with locking gear. When these lower ones are closed and locked the whole of the sewage flows into the Southern Outfall Sewer, but should it rise above the lower ones it will open the small upper ones and flow into the creek. The lower flaps can be unlocked so as to let the whole of the sewage, etc., into the river in case of accident. Penstocks are also fitted to the pipes carrying the sewage under the creek before mentioned, so as to shut it off from the outfall sewer. These sewers are constructed in clay toward the upper portion, and sand in the lower.

The Low Level commences at Putney, and flows through the low grounds before mentioned, but at some distance from the river, to the pump well at Deptford Pumping Station. It intercepts the whole of the main valley lines, and is provided with several storm overflows. In the low-lying grounds between the Low Level Sewer and the river the old ditches had been and the sewers were constructed with a fall generally from west to east, by which means they discharged at a lower point in the river. In order to intercept these a branch called the Bermondsey Branch was constructed from the Low Level, in a northeasterly direction, which receives the remainder of the drainage of the Earl, Battle Bridge, and Duffield Main Sewers.

The most important works upon the Low Level and its branches are:

A tunnel from Kensington Church to Old Kent Road, one thousand feet in length, carried under a very large number of houses, being only ten to twelve feet below the surface.

A tunnel under the Surrey Canal, the soffit of the arch being only eight feet below the water.

Also another tunnel under the same canal, where the distance of the top of the tunnel from the water was only six feet four inches, the soil being gravel and sand, and the canal having one foot of puddle in the bottom.

Several tunnels under railways, and one under Deptford Creek, where large quantities of water were met with, to overcome which two ten-

foot cylinders were sunk through the sand in the neighborhood to the depth of forty-five feet, in the method before described, and the water was kept down by pumping at the rate of seven thousand gallons a minute. The navigation was kept open by half the river being inclosed at a time in a coffer dam. The upper end of the sewer is in clay, and the lower in gravel and sand.

Deptford Pumping Station is built at the termination of the Low Level Sewer, at the side of Deptford Creek, where a wharf is formed for landing coal for the works. The sewage is here lifted from the Low Level Sewer a height of eighteen feet, into the Southern Outfall Sewer.

The maximum amount of sewage and rainfall to be lifted is about sixty-five thousand gallons per minute, for which purpose four one hundred and twenty-five horse-power engines, of the same type as those before described, are employed, making a total power of five hundred horse power nominal. Three of the engines will usually do the work, one being kept spare for repairs or emergencies. The cylinders are four feet in diameter, with nine-feet stroke. The sewage pumps are single-acting plungers, seven feet in diameter, and four-and-a-half feet stroke. The pump valves are hanging valves, and were originally faced with leather, but India rubber is now substituted in these, and also in those at Abbey Mills and Cross Ness. The pumps deliver into a cast-iron culvert, at the end of which, at its junction with the outfall sewer, is placed a penstock, to prevent any back flow from it. There are ten boilers of the Cornish pattern, thirty feet long and six feet in diameter, with single flues delivering into a chimney shaft one hundred and fifty feet high, and seven and one half feet internal diameter at base and six feet at the top, with ornamental cast-iron cap. The foundations are of cement-concrete. The furnaces draw from the sewer on the plan adopted at the other pumping stations, which ventilates them considerably. The whole of the engines are in one building. Trams connect the boiler-house floor with that of the coal vaults.

Before entering the pump well the sewage is screened by passing through iron bar fixed gratings, from which the filth is removed by scrapers attached to an endless chain. This method is now superseded at the other and more recent stations by the movable cages before described. Other particulars of engines and workshops are similar to those already detailed.

The Southern Outflow Sewer commences at Deptford Pumping Station, where it receives the contents of the High and Middle Level (or Effra branch) Sewers, brought by gravitation under Deptford Creek, as before explained, as well as that of the Low Level, after being pumped up into it by the Deptford engines. It passes under Greenwich and Woolwich to the pump well at Cross Ness Pumping Station on Erith Marshes.

The principal work on this line is a tunnel under Woolwich, a mile long, formed in the chalk. Great difficulty was experienced in forming the foundation across the marshes where large quantities of water had to be contended with. With the exception of the tunnel this line is formed in gravel, peat, and sand. The thickness of the brickwork is eighteen inches, and it is entirely laid in cement.

Cross Ness Pumping Station and reservoirs are situated on the south side of the river, about twelve miles below London Bridge. As is the case on the northern side, the sewage is only discharged at about high

water or within two hours of that time; but the outfall sewer is of such a level as to be able to discharge at about low water if necessary.

A penstock fitted to the outlet diverts it into the pump well through a culvert forming the lower one of a tier of three. The upper one takes the sewage from the pump to the reservoirs, and the middle one takes it from the reservoirs to the river outlet. Culverts are provided so that the sewage can also be discharged direct from the pumps into the river without entering the reservoirs.

The outlet from the outfall sewer into the river is formed of twelve cast-iron pipes, four feet four inches in diameter, carried under the fore shore into the bed of the river; in front of their mouths is a paved apron, the other ends being connected by a bell-mouth with the sewer. The foundations for the reservoirs and buildings are carried down through the peat to the gravel, a distance of twenty-five feet.

The ordinary quantity of sewage to be lifted is about sixty-five thousand gallons per minute, but in cases of storms about one hundred and twenty thousand gallons. The lift varies from ten to thirty feet, being the least when the greatest quantity is flowing in from the outfall sewer; so that when the most power is required the lift will be at a minimum, thus lightening the engines in one way, which leaves the power to cope with the extra quantity.

There are four engines of one hundred and twenty-five horse-power each, in all five hundred horse-power nominal, being of the same type and power as those provided at Deptford. The reason that the power provided at Cross Ness is only equal to that provided at Deptford arises from the fact, that in case of a paucity of power at Deptford on the occasion of a storm, the low-lying districts of London would be flooded; but should such a case occur at Cross Ness, the outfall sewer would act as a reservoir (containing four million cubic feet, or as much as the Cross Ness reservoir), until the pumps could relieve it, without flooding any property. The engine cylinders are four feet in diameter, with nine-feet stroke. The sewage pumps are single-acting plungers, eight to each engine, and four feet six inches in diameter, four having four feet six inches stroke, and the remainder two feet three inches stroke. Any or all of them can be thrown out of or into gear to meet the varying lift and requirements. The beams are in two flitches, and are forty feet long between centers. The fly-wheel is twenty-seven feet in diameter, and weighs fifty tons. The boilers are twelve in number, and are single flued Cornish boilers, similar to those at Deptford. They communicate with a chimney shaft two hundred feet in height, and eight feet three inches internal diameter throughout, the foundations for which are twenty-five feet below the ground level.

The sewage is delivered from the pumps into a wrought iron tube discharging into the brick culverts before mentioned, and thence into the reservoir. There are two tiers of eight openings in each of the four compartments into which the reservoir is divided. The upper tier is for the inflow of the sewage from the pumps, and the lower for discharging into the river. All of these are fitted with penstocks.

The reservoir covers six and a half acres, and is seventeen feet deep, and capable of holding four and one third millions cubic feet of sewage. It is covered in with brick arches, in a similar manner to the reservoir at Barking.

The engines are in one house, one hundred and fifty-four feet long by fifty-three feet wide. The boiler house is one hundred and twelve feet long by sixty-four feet wide.

The filth intercepters are the same as those in use at Deptford Pumping Station. A wharf is formed along the river-front for landing coals, etc. The coal vaults communicate with the boiler houses by means of trams, which are also laid on the wharves and workshops. Workshops, cottages, a manager's house, and a school for the workmen's children, are provided and conveniently arranged.

MATERIALS USED AND OTHER PARTICULARS IN CONNECTION WITH THE MAIN DRAINAGE.

The bricks used throughout the works are the best picked stocks or Gault clay bricks. The inverts of the sewers are formed of Staffordshire blue bricks laid in cement. The whole of the lower half of the sewers is laid in cement, formed, in some cases, of equal proportions of Portland cement and sand; the upper half is laid in Lias lime-mortar containing two of sand to one of lime. Where the ground is treacherous, or the sewers are in tunnel, they are generally laid entirely in cement.

The Portland cement used was of the best quality, weighing one hundred and twelve pounds per striked bushel, and capable of supporting a tensile strain of four hundred pounds per square inch, seven days after being mixed and placed in water, during the whole of that period.

The lime concrete consists generally of six parts of clean river ballast to one part of ground Lias lime.

The cement concrete varies in its composition according to its situation, namely: from ten to six of ballast to one of cement.

The stone dressings to the buildings are of Portland stone, and the flaggings of Yorkshire stone.

The whole of the iron, lumber, and other materials are of the best obtainable quality.

The sewers are ventilated, as before noticed, by being connected with the furnaces. There are also ventilating shafts from five hundred to six hundred feet apart in nearly all the sewers. These communicate with the street after passing through a catchpit, which receives the mud that falls through the grating in the roadway, and thus prevents it from getting into the sewer. (See Plan No. 6, Figure No. 1.)

Various methods have been and are still being tried to deodorize the gases before they reach the street, but no universal system has as yet been adopted. Two of the principal methods are as follows:

By causing the gases to pass through a charcoal filter placed in the opening between the ventilating shaft and the catchpit.

By hanging, in the ventilator shaft, a long strip of flannel, which is kept saturated by capillary attraction with sulphurous acid, contained in an earthenware vessel which is periodically filled.

Both of these methods are efficacious, but troublesome and expensive. Exclusive of these purifiers there is little or no annoyance from the ventilators in the streets, and none whatever from those over the new main sewers, in consequence of the unintermitting flow in them.

Access is obtained to the sewers through shafts and passages with steps, and the entrance is closed with an ingenious double door or cover, so arranged that when men are at work in the sewers the top or solid one may be left open, while the bottom, a perforated one, is closed, thus allowing a free passage of air without any interruption to the foot-passenger traffic above. The side entrances are placed in the pavements

and have an arched way communicating with the sewers. (Plan No. 6, Figure No. 1.)

In constructing the sewers in tunnels it was found necessary, where they were not in the clay, to leave a large portion of the timbering used for supporting the sides and roof in its place, and to pack around the sewer with concrete. (Plan No. 7.)

A large number of the principal old sewers have been reconstructed, and their courses have been straightened; uniform gradients, proper sections, and improved outlets being at the same time given to them, but the cases are too numerous to mention.

The district and less important sewers or feeders are gradually being reconstructed by the district or local Boards, under whose control they exist.

Flushing gates are provided in most of them, by which, in the dry weather, the sewage is penned back and allowed to accumulate behind them, when they are suddenly opened, causing a violent rush along the sewer, and thus scouring away any accumulated matter. All these gates are worked by machinery.

Before flowing into these sewers, the rain water and washings from the streets are carried down the channel gratings into a catchpit about six feet deep. The solid matter sinks to the bottom to be removed when required, the liquid rising and passing down a syphon-trapped pipe into the sewer beneath, thus preventing the heavy sand and a great deal of the solid matter from entering them and causing deposits to take place. The gully grates are from 16 inches by 18 inches to 16 inches by 24 inches, of cast iron and of great strength, hinged to a cast-iron frame. They are placed in the side channels on both sides of the street, about eighty feet apart, alternating from side to side, or in other convenient positions, as occasion arises. All connections with the district sewers, whether from houses or street gullies, have a flap fixed at their junction to keep back the gases, or the sewage, should it rise too high in the sewer. (See Plan No. 6, Figure No. 2.)

In all of the new streets lately constructed in the denser portions of the metropolis, large subways (as in the case of the Thames Embankment) have been formed, in which are laid the gas and water mains; and it has been found convenient in most cases to construct the sewers beneath them.

The total sewage of the Northern Division is about ten and one half million cubic feet per day; the total rainfall provided for the Northern Division is about twenty-eight and one half million cubic feet per day; the total sewage of the Southern Division is about four and one half million cubic feet per day; the total rainfall provided for the Southern Division is about seventeen and one half million feet per day. Provision is made for an increase of sewage in the Northern Division of one million cubic feet per day. Provision is made for an increase of sewage in the Southern Division of one and one quarter millon cubic feet per day. Making a total of sixty-three millions of cubic feet per day. There are in all about eighty-three miles of main or intercepting drains, and about one thousand three hundred and fifty miles of other sewers.

The steam-power provided is: (1)

(1) Is equivalent for drainage purposes to raising the whole of the district pumped to the height of the corresponding lifts.

Northern Division.	
At Western Division Pumping Station......	480 horse-power, nominal.
At Abbey Mills Station........................	1,136 horse-power, nominal.
Southern Division.	
At Deptford Mills Station........................	500 horse-power, nominal.
At Cross Ness Mills Station........................	500 horse-power, nominal.
Total..	2,616 horse-power, nominal.

The amount of coals that will ordinarily be consumed is about twenty-five thousand tons per annum.

The total cost of the main drainage system when complete will be about £4,500,000. Any details of cost for the purpose of comparison with similar works would be useless and misleading, as the great and constant variations in prices of materials and labor prevent any standard being laid down on which the basis of an estimate could be formed. For instance, the Cross Ness pumping engines cost in eighteen hundred and sixty-four, £90 per horse-power, nominal, whilst those at the Western Pumping Station, by the same makers, cost in eighteen hundred and seventy-two, £120 per horse power, nominal, being an increase of thirty-three per cent. Cement concrete has varied on these works from 6s. 6d. to 11s. per cubic yard, and brickwork from £13 to £21 per rod.

Several attempts have been made to utilize the sewage brought down by the outfall sewers. The first company started with a proposed capital of £2,000,000, obtaining a concession for thirty years exclusive use of the sewage on the north side of the river, from the Metropolitan Board of Works. Its intention was to carry the sewage several miles down the river to the marshes and reclaim them, using the sewage to irrigate, and at the same time to elevate their surface. After expending about £300,000 the scheme was abandoned. The only portion of the work still in operation is a small farm of about two hundred and fifty acres, on which the sewage is used for irrigation, and, as it appears, with a tolerable amount of success.

On the south side of the river a company was started to precipitate the fertilizing matter contained in the sewage by a method known as the "A, B, C," process. A considerable amount of capital was expended in experiments and the laying out of works, but after they had been in operation about a year they also were abandoned, and since then no further attempts at utilization have been made.

In conclusion it may be remarked that it has been found necessary to construct a large sluice-gate in the Southern Outfall Sewer, as a considerable deposit of sand was found to have accumulated in it. But, whether this arises from the sewer, which is on very treacherous ground, having sagged, or that because a large area drained by it has not been provided with catchpits at the street gullies, has not been made known.

A cause of trouble has also arisen from the fact that so small an amount of sewage is carried from the Southern High Level and Effra Branch into the outfall that after a comparatively slight rainfall, the sewage escapes at the overflow in Deptford Creek in a far too undiluted condition. This gave rise to some litigation between the inhabitants and the Metropolitan Board of Works, but it has been amicably arranged.

THE DRAINAGE OF PARIS.

The Paris Basin is drained by the River Seine, which runs through it generally from east to west. The southern bank slopes gradually upwards from the river to the extremities of the city with an almost unbroken surface.

The northern bank has one slope bordering on the river, and beyond its summit there is another slope in a northerly direction down to the Brook of Menilmontant. This brook runs parallel with the Seine for some distance, and then turns to the south and flows into it at a point rather beyond and to the west of the city.

This brook, or "great drain," receives the drainage of the northern slope of the south bank. The southern slope, together with the south bank and the islands of St. Louis and Notre Dame, drain direct into the river.

In eighteen hundred and thirty-three a complete survey was made of the existing drains, and their respective levels ascertained, with a view to intercept as many as them as possible, and to carry the sewage beyond the city boundaries.

The house sewage, or fæcal matter, has no connection with the drains of Paris, except in one or two cases. Most of the houses in Paris are built in blocks, having a central court-yard common to all. In this is usually formed a cesspool, which receives all the night-soil, etc., and is emptied at intervals. This operation is carried out almost entirely without unpleasant smell. The exceptions, above alluded to, are where in some parts of the city and at barracks a new system is being carried out. It consists in conveying the night-soil by earthenware pipes from the houses into cylinders in connection with the branch drains. These cylinders are perforated with small holes, which allow the liquid to flow through into an outer casing, leaving the solid matter within. The internal or perforated cylinder is withdrawn at intervals and emptied. The night-soil from the cesspits and these interceptors is carted away. Much of it is sold and converted into manure, but large quantities are still wasted.

The duty which the new sewers have to perform is to carry off the rainwater and house-slops.

A large portion of the city was continually being flooded by the river, so that whilst carrying out the new drainage scheme the river was embanked above ordinary flood level, in consequence of which the sewers are enabled to drain the lower districts satisfactorily during heavy storms.

By the new scheme the city was divided into five drainage areas or districts:

1. The South Bank, the sewage of which is carried in one main sewer along the river bank. It then crosses the river by two iron syphon pipes, and discharges into the great main sewer on the northern bank.
2. The Isles of St. Louis and Notre Dame, the sewage of which is discharged through two outlets, under the banks, into the river.

3. The Right Bank, Southern Slope, the sewage of which discharges into the great main. This sewer is carried along the river bank to its junction with the northern syphon, and thence to its outlet at Asnières.

4 and 5. The Right Bank, Northern Slope, and Extra Mural—both of these areas discharge into the "great drain," which empties into the river at St. Denis.

Before these main sewers were constructed it was necessary to remodel the existing drains, and to drain a large portion of the town at that time without sewers. The only available means for getting rid of the rain water, etc., were by open channels down the center of the streets.

The Parisian sewage discharges, as will be seen above, into the Seine by two outfalls—one at Asnières and the other at St. Denis (excepting the islands, which discharge as described)—the former being of five times a greater capacity than the latter. The natural formation of the city has allowed the new sewers to be so constructed that they discharge, at the outfalls, into the Seine by gravitation alone, without any assistance by pumping.

The forms of the sewers adopted for the new drainage system are shown on Plan No. 8, Figures 1 to 8—the minimum inclination or fall being three feet three inches per mile.

As, however, it was not possible to give the main sewers a sufficient slope to enable them, under all circumstances, to carry off the heavy matters in suspension, it has become necessary to resort to hand labor and mechanical agency to get rid of the accumulated deposit.

In order to form sewers of such magnitude as the above, it was necessary to raise a great many streets, and otherwise alter them. The surfaces of the roads were altered from a concave to a convex cross section, having gutters at the side instead of in the center, as formerly. This entailed a heavy expenditure, and the carrying out of some very diffiult work. For instance, in the Rue Lafitte, and at the foot of the Rue des Martyrs, a new drain was built to carry below the surface of the road all the rain water, which previously poured in torrents down the Rue du Faubourg Montmartre, lying immediately below it. The difficulties met with in the execution of this drain were very great. In the first place, it was necessary, for some distance, to sink it at a depth of about nineteen feet below the surface. This was done in open cutting, in the lower beds of which the soil was semi-fluid; and in the second place there were most offensive exhalations from the foundation. This drain was carried below that in the Rue des Martyrs, and, at the point of crossing, a large cast-iron pipe was used.

Many other instances occurred of extremely difficult character.

A comparison between the old and new sewers shows a great difference in two respects: First—In the new sewer the area is many times greater, though that portion allotted to the sewage is about the same. Second—In the formation of footpaths and tramways at the side of the sewers. The most general form of sections used are shown in Figures 1 to 5, but where it is impossible to obtain the required height, the less important sewers are built as shown in Figures 6 and 8. It will be seen that the general section is composed below of an almost rectangular trough, the bottom being slightly curved, and the corners rounded. Above this, the width is greatly increased, so as to give a platform on each side of the trough. The trough forms the ordinary channel for the sewage, but in heavy storms the water runs above the level of the footway, and more or less fills the whole arch. In this case, the work-

men have to rapidly retreat for safety, and to facilitate this end, chambers have been built as often as possible, where the headway will allow, in the crowns, or roofs, of the drains. These chambers are reached by an opening in each side of the side walls, ladder irons being built into the masonry, projecting about six inches, and forming a means of ascent to the crown of the arch in the side opening, and communicating with a flight of steps leading to the chambers formed on the extrados of the sewer. On the south side of the river, the levels of the surface above the main drain do not admit of any such chambers being constructed, consequently a number of shafts, communicating directly with the street, have had to be formed, up which the workmen can escape.

In the arched upper portions of the sewers which form subways, brackets are built into the masonry to carry the water and gas mains, pneumatic tubes, and telegraph wires, thus preventing the constant disturbance of the street surface, so common elsewhere.

The principal sewer at Asnières collects the sewage of about thirty square miles, containing sixty-six thousand houses, and about one million eight hundred thousand inhabitants. On an average the stream has a width of eleven feet and six inches, and a depth of three feet and eight inches, flowing over about eight inches of mud, and a speed of three feet per second, discharging about eighty-nine cubic feet per second. At St. Denis the speed is one foot and eight inches a second, and the discharge about sixteen cubic feet per second—equal to about eight million one hundred thousand cubic feet per day—which is rather less than the water supply, though the observations include the average rainfall. The outfall varies according to the hour of the day, and it is easy to trace the variations in the cleansing of the streets and in domestic services. But besides these causes the outfall is affected by variations of rainfall. In December, eighteen hundred and sixty-eight, after continuous rains, the speed of the current at Asnières exceeded six feet and six inches, and the quantity two hundred and eighty-one cubic feet per second. In May, after an exceptional storm, the rate was thirty-two feet and six inches, and the quantity one thousand five hundred and eighty-four cubic feet per second, making a daily outfall of one hundred and thirty-seven millions of cubic feet. Sand is stored in heaps along most of the roads, to fill the puddles and maintain an even and dry surface. During a fall of rain this is worked into mud and carried, together with the road refuse, into the drains. The large section of the drains prevents the water, except in cases of storms, running to more than a couple of feet in depth in the generality of them, and often not more than a few inches in the Summer. In consequence of this, the flow in them is so sluggish as to allow of even the suspended matter in the sewage depositing, so that the sand, etc., from the roads, rapidly accumulates, and has to be removed by a large staff of men employed for this purpose. Some of the means used to remove the deposit are as follows: such drains as have not a pathway formed in them are cleansed by hand labor, the mud being removed through the air-shafts by seventy or eighty men and thirty carts. Those drains having pathways are all cleansed by mechanical contrivances, which differ in some details, according to the sizes of the sewers.

The larger sewers are cleansed by means of a large iron scraper attached to the bow of a shallow boat; this scraper nearly fits the section of the sewer, and can be raised or lowered from the boat by machinery. The modus operandi is to lower the scraper till it is a sufficient depth in the mud; it thus forms a dam behind which the

water accumulates until there is enough force to propel it, and the mud in front of it, forward. When so much mud has thus collected as to stop further progress of the boat and scraper, valves, formed in the sides and bottom of the scraper, are opened by the workmen in the boat. The pent-up water rushes through these openings, stirs up the mud in front of the scraper, keeping it in suspension (this is also assisted by men with scrapers), and in this way a further length of the sewer is cleaned. The mud is often of so great a depth as to prevent removal by one operation; in which case the scraper is only partially lowered into it, and the residue cleared by a second or third operation. In dry weather, it often occurs that there is not sufficient water to work this boat, in which case a length of the sewer is dammed by means of an iron frame, which is ordinarily suspended to the roof of the subway, being lowered by machinery into the water-way, which it exactly fits, and where it is kept in position by chains. In this way enough water is penned back to admit of the boats and scrapers being brought into operation. The boat is kept in proper position by a cross-head fixed horizontally at the stern, having iron rollers at its extremities. These can be adjusted so as to work up against the water-way, and prevent the possibility of the boat slewing. Each boat is attended by three men, and is fitted with seats and tool locker, etc. It has been found that under even the most favorable circumstances, not more than one thousand yards of sand can be cleared in this way per day.

The smaller drains are cleaned by means of a truck running on a rail fixed on each pathway so as to be over the water-way, and having a scraper, similar to that before mentioned, attached to it. This can be raised or lowered by a crab-gearing on the truck, the cleaning being performed as before detailed. The rails are formed of angle irons.

When a sufficient quantity of mud has collected at one spot, it is lifted by workmen into tipping trucks running on the rails laid on the pathways, and they are then run out to the tipping station, discharging their contents into barges to be carried away. There are two tipping stations—one at the Place du Châtelot, for the sewers on the north bank of the river, and the other at the Quai St. Michel, for those on the south bank. The sewers are not usually cleaned until the mud has accumulated to a depth of four or five inches.

The velocity of the Seine is not sufficient to carry off the heavy matter emptied into it from the outfalls, and, consequently, mud deposits in the river bed, and has to be cleared away by dredging, at a cost of three thousand two hundred pounds per annum.

There are seven large store chambers constructed at different parts of the city, in which the boats, wagons, scrapers, tools, etc., are kept. These chambers are approached by a flight of steps, leading from the pavements above, the entrances to which are closed by large iron doors. One of these chambers measures not less than one hundred feet by forty-five feet, by fifteen feet high, and is covered by a segmental arch. Rails, sidings, turntables, and all other conveniences for carrying on the work of cleansing and repairing, are amply provided.

Notwithstanding the necessity for breaking up and agitating the mud, there is no offensive effluvia whatever arising from the sewage water.

Storm overflow weirs are provided at several points along the courses of the main sewers.

The materials of which the sewers are built vary considerably. The main sewers are constructed of coursed rubble sandstone, the joints

being pointed with cement. The old branch drains are built of stone, random rubble, with ashlar inverts, the whole of the inside being plastered. The new branch drains are formed of either of two materials. One consists of coarse sandstone, in small unbedded pieces, laid in a kind of mortar made of unsifted sand and gravel and hydraulic lime. It is laid in a dry, stiff state, very little water being used. This mortar comprises about sixty per cent of the whole of the material of which the drain is formed. The other consists of *béton*, or concrete, formed of clean river sand and ballast and Roman cement, in the proportions of five to one. The interior of all these drains is plastered with hydraulic lime, or Roman cement and sand. The foundations of most of the sewers are formed of concrete.

The total length of sewers in Paris is about two hundred and fifty miles.

Subjoined is a comparison between some of the principal features of the drainage of London and Paris:

LONDON.	PARIS.
The drains receive every kind of sewage.	The drains receive only rainfall, household water, drainage from public urinals, and the liquid portion of the drainage of a few houses, etc.
Night soil is carried off by the sewers.	Night soil is collected in cesspits and removed by hand labor.
Road washings are carefully excluded from the drains.	Road washings are received into the drains.
The sewers are used for sewage alone.	In addition to the sewage the sewers receive gas and water mains, etc.
The drainage is effected by gravitation and pumping.	The drainage is effected entirely by gravitation.
There is a tide to contend against.	There is no tide, but a stream to carry away suspended matter.
The principal outfalls are fourteen and fifteen miles from town.	The principal outfalls are one mile and one and a half miles from town.
The river is tidal, and therefore any sewage discharged into it near the town is brought back by the returning tide.	The river is not tidal, which prevents the return of sewage matter discharged into it.
Great economy exists in having small drains.	Large drains are necessarily expensive.
The egg-shape sewer, and the circular, where there is a constant and large flow, give the greatest hydraulic mean depth, and consequently the strongest current.	The wide flat section for the water-way gives a minimum depth, and weak flow consequently.
With an inclination of one in two thousand six hundred and forty, or two feet per mile, there is little or no deposit.	With an inclination of three feet three inches per mile, and even one in one thousand, there is much deposit.

LONDON.	PARIS.
Nine-inch pipes are used.	The smallest sewer built is five feet six inches by two feet six inches.
The highest mean temperatnre in Summer is sixty-two degrees, and the mean temperature fifty-five degrees.	The mean temperature throughout the year is sixty-three degrees.
The sewage contains seven parts of oxygen per one hundred thousand, and holds sixty-nine and one half in suspension, of which sixty-one per cent are mineral.	The sewage contains four parts of oxygen per one hundred thousand, and holds one hundred and ninety six parts in suspension, of which seventy-five per cent are mineral.
The cost of flushing the sewers and emptying the catchpits, etc., is forty pounds sterling per mile.	The cost of cleansing is one hundred and twenty pounds sterling per mile, exclusive of the cost of the emptying and removal of the contents of the cesspools.

E. B. S. KNOX, Assos. Inst'n C. E.,
Late Engineers' Department Met. B'd W'ks, London.

POISONING BY GUM BOOTS, ARSENICAL FABRICATIONS, ETC.

By T. M. LOGAN, M. D., Secretary State Board of Health.

Early in the present Summer the attention of this Board was called to an article in the Oroville *Mercury*, Butte County, stating that "the gum boots, so universally worn by gravel miners, have latterly been lined with green flannel, the dye of which is unquestionably arsenicated, and which has poisoned many persons, some fatally." Knowing how common the use of arsenic in arts and manufactures has become, and therefore apprehending that there might be some truth in this statement, I wrote to several physicians, practicing in the mines, and requested them to investigate the matter. Dr. Miller, of Oroville, promptly responded to the request, and satisfied me that there was little or no foundation for the statement. The matter, thus disposed of, soon passed from my mind, and the correspondence was so carefully hid away for future reference, that it cannot now be laid hands upon. Recently the question has again been opened by *The Mining and Scientific Press*, and other papers; and, as will be seen, in the appended communication, Dr. Miller has again responded to a second application on my part.

Although Dr. Miller, after proper investigation, has come to the conclusion that the injury inflicted by the use of gum boots, in the cases examined by him, was not attributable to the arsenical green dye of the lining, still there is no good reason why such a contingency may not occur; and for this, as well as other considerations, it is deemed that the subject is one which warrants solicitude in behalf of the public health, and exacts something more than a passing notice.

Arsenic forms an ingredient of two pigments in constant use, the arsenite of copper, Scheele's green, and the aceto-arsenite of copper, Schweinfurt green. Either of these combinations have, on account of their comparative cheapness and brilliant color, always maintained favor both with manufacturers and the public in general. So important has their application been considered in the application of wall paper, of artificial flowers, and other articles of decoration and dress in Paris, that when at one time it was agitated, whether it were practicable to prohibit the use of arsenic in these arts, certain manufacturers protested that such an edict would necessitate the absolute suspension of their works.

In eighteen hundred and sixty, a manufacturer of paper hangings in England stated that he used two tons of arsenic weekly, (1) and the amount of the color annually manufactured in that country was

(1) Taylor on Poisons.

estimated in eighteen hundred and sixty-two, at from five to seven hundred tons (1). In fact, so general has become the employment of arsenic throughout the world, that "we doubt very much whether it would not be impossible, at the present day, in any country, to convict on chemical evidence before any jury, the most bungling arsenical poisoner, if he or she had a legal defender who would make such use as he might of the argument furnished him by the almost universal distribution of the venomous elements throughout our most familiar walks of life. We have received medicines, ourselves, from the drug stores, wrapped in arsenical papers put up in Paris-green paper boxes, with arsenical paper caps tied over the corks, etc. We have often seen confectionary exposed for sale to young children wrapped in the deadly green paper. We have often found young children sucking toys painted with the horrible stuff, and with their mouths stained throughout with the venom. The Paris-green paper is one of the commonest in use for binding school books, and we have more than once taken such books away from our own young children, which had been given them by their teachers. Numerous deaths of children are well known to have been thus occasioned. No country can be called civilized in which such suicidal ignorance, such stupid slaughter of the innocent, is common. One more illustration only. It is very common to see a lawyer or his clerk, put into his mouth, to moisten the gummed sides of it, a beautiful green paper disk, with scolloped edges, to attach to some document. These things are found in every lawyer's office in the land, and used constantly. They are seldom made of any other than the Paris-green paper. * * * These things, we say are facts, on both sides of the Atlantic; but, really, while we wrote the first part of this article—especially when we thought of the recklessness of the public press, which has actually recommended their rural readers, in many cases, to pile on the Paris-green on their potato patches with a perfect looseness—these other things seem trifles as flat and stale as they certainly are unprofitable; and our enthusiasm and zeal for the cause of humanity seems to wilt down into a sort of sentimentality, which is certainly ludicrously lame and impotent, if not downright sickly." (2)

It must not, however, be inferred from what has just been stated, that all green pigments in ordinary use are arsenical. Not a small proportion of the green colors employed for dyeing or color printing, and other artistic work, are of comparatively harmless composition. As it is not always easy to distinguish them by their physical appearance, we here give the ready test which chemistry affords, and which may be easily applied. The suspected green material is to be placed in a solution of ammonia (aqua ammoniæ). If arsenite of copper be the coloring agent, the liquid will acquire a blue tint, from the disengagement of the oxide of copper from its combination with the arsenic. If a further test be desired, a few drops of the colored ammonial solution poured upon crystals of nitrate of silver, will leave on the crystals a deposit of yellow arsenite of silver.

Having said this much by way of affording a ready means for the detection of this universal poison, as well as for the purpose of warning the public of the dangers pertaining to its indiscriminate employment, I now leave the following communication to speak for the case in point:

(1) Fifth Rep. of Med. Officer of Privy Council, 1863; as quoted, in 3d Annual Rept. of St. Bd. of Health of Mass.

(2) Prof. Henry Wiertz, *American Gas Light Journal.*

Doctor T. M. LOGAN, *Secretary of the State Board of Health:*

MY DEAR DOCTOR: I regret exceedingly the loss of my communications with you relative to the reputed cases of poisoning by gum boots alleged to have occurred in Stringtown, Butte County, and reported in two issues of the Oroville *Mercury*.

Protracted illness in my family has almost rendered me, for the present, unfit for any thing like mental exercise, but as a report of the matter is considered by you interesting and necessary for the furtherance of the public welfare, I will endeavor to give it my best attention and consideration, and, although brief, perhaps, sufficiently explicit to convey my impressions of a subject which I characterize as the emanations of a fertile but prejudiced mind.

Sore legs, as they have been termed, occurring from the continued use of gum boots, were and are no rare phenomena in this part of the country, even dating from eighteen hundred and forty-nine, down to the present day. On the contrary, the absence of such conditions were very rare until it was discovered that daily ablution and other cleanly measures exercised a prominent part in the prevention of these superficial morbid conditions, which, when neglected, became a source of much constitutional trouble. There are, however, many left, whose habits cannot be changed, and no adequate amount of reasoning can adapt them to the same channel of thought as is followed by those who consider the daily employment of gum boots (if this important matter be neglected), receptacles of pent-up animal matter, and perspiratory exhalations: conditions which finally produce varices, chronic inflammation, œdema, together with indolent ulcers of the parts subjected to undue heat by the close fabric and water-tight material of which gum boots are made. The most casual observers of the effects of gum boots are acquainted with the fact that no bad results follow their use so long as cleanliness is strictly observed; but when the opposite plan is indulged in, the usual phenomenon of the want of ablution and ventilation is quickly manifested in the conditions already related.

It is needless to mention that the reports of this affair which appeared in the *Mercury*, are based upon one single case of inflammation of the legs, brought about by causes already alluded to; and so far as the assertion goes that there are large numbers suffering from the symptoms of poisoning, I can only regard it as a false and most unwarrantable report. I promptly examined the man, the subject of his report in the *Mercury*, and found him—just as I expected—merely complaining of chronic inflammation of his legs. He distinctly refused me a proper and thorough examination of his case unless I promised, under any circumstances, to give evidence in favor of the theory of the poisonous effect of gum boots, should an action for damages be instituted against the boot companies. This I denied him most emphatically unless I could discover poison in the green lining. The other cases of which the same writer to the *Mercury* made mention, I will briefly notice, since I am thoroughly acquainted with them. They are the subjects of chronic rheumatism, arising as a sequel of remittent fever, of syphilitic nodes, lepra vulgaris, and psoriasis. Varices occasioned by inflammation, the result of heat originating from the constant use of gum

boots, is generally the condition denominated as poisoning by the writer in the *Mercury*. Indeed, while writing this report, I was consulted by an intelligent miner (John Gramps, of North Fork, Feather River), regarding a swelling of his legs, from whom I solicited the following remarks:

"I enjoyed excellent health till within the past two years, when I observed a swelling of my legs. There has been considerable pain together with unbearable itching ever since. Never paid proper attention to my feet and legs. Did not consider it necessary. Have been wearing gum boots of Hawyard's and National Rubber Company's brands for the past sixteen years. Always suffered more or less from itching consequent on their use. Attribute the irritation and tingling of my legs to heat and excessive perspiration induced by the wearing of all kinds of rubber boots. Have never suffered from general irritation of the skin, nor suffusion of the eyes. Have not suffered from inflammation of the conjunctive. Have not complained of intolerance of light, nor a falling off of the hair. Was at no time partially paralyzed."

Having thus obtained the information I desired, I proceeded to examine the condition of his legs, and found an excellent example of varix of the internal saphenous vein, together with considerable inflammation, and a strong tendency to ulceration. You will observe that no symptoms of chronic poisoning by arsenic are observable in the history of the above case, and much less have such symptoms been perceived in those who suffer from chronic diseases and enumerated as poisoning by gum boots by our local writers. I have tested the fabric with which the Hawyard's and the National Rubber Company's boots are lined, and find no trace of arsenic or any other poisonous coloring matter. The green linings which I subjected to a chemical analysis for arsenic were taken from boots cast away as unfit for further use, bearing the brands of Hawyard, Colchester, Conn., and that of the National Rubber Company, R. I. For that reason it is barely possible the poison may have been disengaged from the flannel (if it contained any) whilst in use. The result of my investigations, however, does not bear out such a supposition, for I think that Hawyard's latest patent in which a grey felt textile is employed instead of green lining as heretofore, is as productive of the bad results generally attributed to gum boots as that manufactured by the National Rubber Company, who employ no other lining but the green which has been so long in use. I have received much important information on this matter, from gentlemen of experience. Among them Mr. West, of Oroville, a gentleman of intelligence and integrity, and find the bulk of reliable evidence in favor of the opinion which I have already expressed. Trusting that my endeavors at a solution of this question may be satisfactory,

I am, dear sir,

Fraternally yours,

P. B. M. MILLER, M. D.

OROVILLE, August 25th, 1875.

REPORT

OF THE COMMITTEE OF THE "CALIFORNIA STATE MEDICAL SOCIETY" ON STATE MEDICINE AND PUBLIC HYGIENE, CONTAINING A DRAFT OF "AN ACT TO PROTECT THE SANITARY INTERESTS OF THE PEOPLE AGAINST FRAUD AND IMPOSTURE IN THE PRACTICE OF MEDICINE," APPROVED APRIL TWENTY-SECOND, EIGHTEEN HUNDRED AND SEVENTY-FIVE.

By THOMAS M. LOGAN, M. D., Chairman of the Committee.

MR. PRESIDENT AND GENTLEMEN: In my report, as Chairman of the Committe on "State Medicine and Public Hygiene," I called the attention of the society, at the last meeting, to the necessity of making some provision for the regulation of the practice of medicine in this State. I took the position then which I held before the passage of the Pharmacy Act of March twenty-eighth, eighteen hundred and seventy-two, and which I still maintain, that it is as much our duty to protect the public against the evils of dosing patent medicines, and, perhaps, the greater evil of swallowing the improperly compounded prescriptions of competent and incompetent doctors, as it is to point out and provide against the noxious influences of foul air, or the poisonous gases of filthy sewers.

If this committee was appointed to propose measures for the consideration of the State Board of Health, looking to the enactment of sanatory laws to protect the people from whatever may be found detrimental to human life, is it not also incumbent on them to insist upon further legislation to prevent the destruction of that same life by the illicit exercise of a calling under false pretenses?

Influenced by such considerations, I asked, with a view of devising some means for the practical solution of this question, that a committee of three or more might be appointed by this society, to confer with the Professors of the schools of medicine in preparing a bill for presentation to the Legislature, and to be submitted for approval at this meeting. It was at the time suggested, that in this bill there should be nominated a State Board of Medical Examiners, to consist of eleven members, viz: the President of the State University (to have only a casting vote), the President of the State Medical Society, the Professor of Physiology in the State Normal School, the Professor of Chemistry in the State University, the Secretary of the State Board of Health, two Professors from each of the medical schools, one Professor from the College of Pharmacy, and the Superintendent of Public Instruction.

The provisions of the bill were to embody the substance of the resolution of Dr. Oatman, concerning the doctorate, lying over from a previous meeting, and to constitute the above named eleven members, in accordance with the resolution of Dr. Morse, an independent State Board of Medical Examiners, with power to confer the medical diploma

of the State upon all candidates, irrespective of the source of instruction in which the applicant had been educated; *provided*, he passed a satisfactory examination in descriptive and pathological anatomy; physiology and histology; principles and practice of surgery; organic and inorganic chemistry; principles and practice of medicine; private and public hygiene; obstetrics and diseases of women; materia medica and therapeutics; and the various branches of elementary scientific knowledge.

The resolution of Dr. Oatman referred to is this:

Resolved, That it is the duty of, and we hereby recommend to, the Legislature of California, to pass a law making it a misdemeanor for any person, for any purpose whatever, who is not a graduate of some institution of learning authorized by law to confer the degree of "Doctor of Medicine," who shall place before or after his or her name, in any manuscript, label, wrapper, card, handbill, circular, newspaper, pamphlet, magazine, book, or any advertisement, the word "Doctor," or the abbreviation "M. D." or "Dr.," or any others signifying, directly or constructively, that person is a graduate of such an institution, or who shall authorize or sanction the same by others in his or her interest; and that any person found guilty of such a misdemeanor shall be punished by a fine of not less than —— dollars, or imprisonment for not less than —— years, or by both such fine and imprisonment.

Dr. Morse's resolution reads thus:

Resolved, That the State Medical Society of California, desiring to see some system adopted by which a high and liberal standard of medical education and graduation may be secured, have heard with great pleasure that our State University contemplates the organization of an independent Board of Medical Examiners, and we do hereby express the hope that such a Board may be appointed, on a foundation so independent, that, upon their certificate of graduation, a diploma of the University will be granted and conferred, irrespective of the school or source of instruction in which the applicant has been educated.

The discussion of the question hinged on the adoption of Dr. Morse's resolution, when the following resolutions, offered by Dr. Henry Gibbons, and accepted as an amendment, were unanimously adopted:

Resolved, That it is desirable that there should be a uniform system of examination for the degree of Doctor of Medicine, apart from the institutions for teaching, so that the diploma shall be awarded to all competent candidates, and the profession, and society at large, shall be secured against the possibility of the degree of Doctor of Medicine being conferred upon unworthy or incompetent individuals.

Resolved, That a committee of five be appointed by the Chair, to prepare and present, at the next meeting of the society, some plan by which the said object may be accomplished.

Accordingly the President named a committee consisting of Drs. Morse, Shurtleff, Logan, Gibbons, and Hewston. Here the question rests; and here, perhaps, it will remain forever.

Were he, whose eloquent tongue so boldly advocated the plan proposed—in fact, who originated it, now present, there might be no misgivings as to its final disposition. Gifted as he was with the rare art of transferring his impulses to others, it is highly probable that he would have borne down all opposition. But the echoes of the glowing words, with which he proclaimed his broad, catholic views, soaring above the senseless *'isms* and *'pathies* of the day, and disclaiming exclusive recognition of any school or college, though still ringing in our ears, will never more be renewed. That voice, which in manly tones, invited all honorable and self-respecting representatives of all sorts of medical practice, irrespective of any denomination, to demand of the law-making power, that it provide some guarantee that the people may not become victims to the ignorant doctor, is hushed in silence forever more. But although Dr. Morse is not here to act his part as Chairman of the committee referred to, and although, perhaps, the ability of any single member of this society would prove ineffectual in bringing about a union of the divergent views as to the method of action and peculiar course he advocated; still I think that if all of us would act as a unit in the great object we have at heart, viz: the protection of the lives of the community, by indorsing some such statute, as soon to be proposed, we would accomplish all that is required.

Looking attentively at the social progress of our day, none of us can fail to observe that the feeling of antagonism, which has hitherto existed between the public and the profession, is rapidly dying out. In fact, no stronger exemplification of Spencer's "working out of sociological processes"—of the marvellous results "indirectly and unintentionally achieved by the coöperation of men, who are severally pursuing their private ends," can be produced, than that of the present relative position of medicine and the public.

Ever since the advent of that equalizing spirit, which, enlightened by a knowledge of political philosophy, set up our popular form of government, but which, at the same time, working in the shadow of an ignorance of medical philosophy, tore down the barriers which protected the practice of our art, have the efforts of the true followers of legitimate medicine been steadily directed towards educating the public mind to a just conception of the real situation.

So long as the people were made to believe, by the cunningly devised sobriquet of allopathist, that the followers of the comprehensive science of medicine were merely the disciples of one of the *pathies*—that if there was a distinction, there was no difference between the homeopathist, and (if I may be allowed to coin a new term), the omnipathist, so long were we helpless and powerless. But thanks to the spirit of forbearance manifested by the members of the profession, while pursuing the even tenor of their ways, and spreading abroad correct, intelligent ideas in regard to medicine, all classes of society have come to understand the principles of our science to a degree sufficient to respect and confide in us; thus insuring to the physician, of the present and succeeding times, a high position, not only in the hierarchy of the sciences, but also in the social scale.

No better evidence of the truth of this assertion is requisite than the fact, which is patent and cognizant to all, not only in California, but throughout the length and breadth of the United States, that the very persons, editors of newspapers, ministers of the gospel, members of our Legislatures, and Judges—law-makers as well as law-expounders, and law-executors—who were once most officious in disseminating the fallacious notions, just alluded to, are now the most clamorous for the enactment of prohibitory laws, to check the present wholesale poisoning by

drugs and medicines. In California, especially, has this reactionary influence been made most plainly perceptible. Owing to the peculiar circumstances under which the State was suddenly settled up by a heterogenous admixture of all nationalities, there were no means of ascertaining the qualifications of the great army of doctors which rushed in. Health and every other consideration gave place to the one idea of getting rich quickly; and when overtaken by sickness, too often caused by the reckless habits of the earlier settlers, the patient called in the physician nearest at hand. Quackery thus became rampant, and diplomas were not of as much value as pocket-knives.

But if California has, for these reasons, suffered more in proportion than the other States from the abuses of medicine, she has taken precedence, in point of age and time, in applying an effectual corrective. The people themselves have taken the matter in their own hands, and through the columns of the newspapers are sifting the competent from the incompetent doctors. And more than this, I have been called upon, as the Chief Sanatory Officer of the State, to prepare a bill for presentation to the next Legislature, looking to the prevention of the practice of medicine and surgery by unqualified persons. I see no good reason why statutory measures, which are now being enacted in other States, should not be resorted to in California, inasmuch as there appears to be no other help, except an appointment of physicians by administrative authority—a plan current in Europe, but offensive to the theories of our government. Without occupying your time, therefore, with the further discussion of the urgent necessity for purging the community of ignorant pretenders, I herewith present, for your consideration, the following, almost *fac simile* of an Act which has recently become a law in our sister State of Nevada, and to which I have annexed (section four) the substance of a proposed amendment, by the Central New York Medical Society, to an Act passed May eleventh, eighteen hundred and seventy-four. I would add that it is also contemplated to have an amendment made to the Act regulating the practice of pharmacy in the City and County of San Francisco, approved March twenty-eighth, eighteen hundred and seventy-two, so that the law may apply to every city and town, wherever there is a drug store, or wherever physicians' prescriptions are compounded.

AN ACT

FOR THE BETTER PROTECTION OF THE SANITARY INTERESTS OF THE PEOPLE AGAINST FRAUD AND IMPOSTURE IN THE PRACTICE OF MEDICINE AND SURGERY.

(As revised and approved by the Committee.)

The People of the State of California, represented in Senate and Assembly, do enact as follows:

SECTION 1. No person shall practice medicine and surgery in this State, who has not received a medical education and a diploma, from some regularly chartered medical school, having a *bona fide* existence at the time of giving said diploma; or who shall not have obtained a license to practice medicine and surgery from a State Medical Society or a State Board of Medical Examiners, duly authorized by law to grant such license when the same was given; or who shall not have received a *certificate of qualification*, to practice medicine and surgery from the State Board of Health of this State, as provided in section four of this Act.

SEC. 2. Every physician or surgeon, when about to take up his residence in this State, or who now resides here, shall file for record with the County Recorder of the county in which he is about to practice his profession, or where he now practices it, a copy of his diploma or license (at the same time exhibiting the original), or a certificate from the Dean of the Medical School of which he is a graduate, certifying to his graduation.

SEC. 3. Every physician and surgeon, when filing a copy of his diploma or license, as required by section two of this Act, shall be identified as the person named in the papers about to be filed, either by the affidavit of two citizens of the county, or by his affidavit, taken before a Notary Public or a Commissioner of Deeds for this State, which affidavits shall be filed in the office of the County Recorder.

SEC. 4. Every person who shall hereafter practice medicine or surgery in this State, unless such person be authorized to practice by a license or diploma from some chartered school, State Medical Society, or State Board of Medical Examiners, shall obtain, and is hereby required and directed to obtain a certificate from the State Board of Health, which Board is hereby authorized and empowered to issue a certificate to the effect that they have examined and do find the persons named in such certificate, and to whom the same shall be issued, qualified to practice all the branches of the medical art, if such be the fact; and the person to whom such certificate, license, or diploma, may be granted, shall, before he shall practice medicine or surgery in this State, cause such certificate, license, or diploma, to be recorded in the office of the Clerk of each county in which such person shall from time to time reside. And the Clerks of the several counties of this State shall procure and keep suitable books, in which they shall record such certificates, tested as aforesaid, and such license or diploma, whenever pre-

sented to be recorded, upon the payment to them of the same fees as required to be paid for recording conveyances of real estate; and shall index, in alphabetical order, the name of the person to whom such certificate, license, or diploma, shall be granted—noting therein, opposite to the name indexed, the book and page where such certificate, license, or diploma, is recorded, the date of the instrument, and of the recording of the same.

SEC. 5. Any person practicing medicine or surgery in this State without complying with sections one, two, three, and four of this Act, shall be guilty of a misdemeanor, and, upon conviction, shall be punished by a fine of not less than fifty dollars ($50), nor more than five hundred dollars ($500), or by imprisonment in the county jail for a period of not less than thirty (30) days, nor more than three hundred and sixty-five (365) days, or by both fine and imprisonment for each and every offense; and any person filing, or attempting to file, as his own, the diploma or certificate of graduation of another, or a forged affidavit of identification, shall be guilty of a felony, and upon conviction, shall be subject to such fine and imprisonment as is made and provided by the statutes of this State for said offense.

SEC. 6. It shall be the duty of the Police, Sheriff, or any Constable, to arrest all persons practicing medicine or surgery in this State who have not complied with the provisions of this Act, and the officer making the arrest shall be entitled to half of the fine collected.

SEC. 7. No portion of this Act shall be so construed as to prevent gratuitous efforts to afford medical or surgical aid and relief in cases of emergency or accident; or to prohibit parents or persons acting *in loco parentum*, from administering medicine or remedies to members of their own families.

SEC. 8. This Act shall take effect and be in force from and after its passage and approval.

REMARKS ON THE CLIMATE OF SAN FRANCISCO AND OF CALIFORNIA,

WITH SPECIAL RELATION TO PULMONARY DISORDERS.

BY HENRY GIBBONS, M. D.

Much has been written concerning the climate, or rather the climates, of California, with special reference to health; and yet but little is positively known in regard to the best localities for consumptives and other invalids. There are intrinsic difficulties in the way of reaching definite conclusions on the subject. Impressions made by a brief sojourn in a place, vary with the individual; the same climate being agreeable to some and unpleasant to others. Meteorological statistics give no adequate idea. The temperature may be equable, but if its range be about the lowest point consistent with comfort, the slighest depression will destroy the benefits of its equability. Air in motion is very different as to comfort and health from air at rest, though the temperature be the same. Moisture is another important element, the precise relation of which to health cannot be represented by figures. Still less tangible is electricity, though potent.

As to the mortuary statistics of pulmonary disease, they are extremely uncertain. A locality unfavorable in this respect may make a good showing, by reason of its abandonment by those who seek relief elsewhere; while on the other hand, the most favorable locality may be made to appear the most fatal, by becoming a place of resort for consumptives from other parts.

There are four elements of climate which are of intrinsic value in a hygienic point of view: first, temperature; second, wind; third, moisture; fourth, electricity. Let us examine these briefly, in detail:

1.—TEMPERATURE.

Judging from temperature alone, the ocean climate of California ought to be most salubrious. Its character is due to an ocean current from the north, the reflex of the gulf stream of the Asiatic Coast. By this polar current the western shore of the Pacific States is continually bathed with a temperature of 52°, with scarcely the slightest variation from Winter to Summer. The ocean imparts its own temperature to the superjacent air, which flows in upon the land in a great and constant wave almost every day for eight or nine months of the year. For the most part this wave is soon arrested by mountain walls. But there are breaks here and there, one notably at the Golden Gate, through which it penetrates, distributing often to a great distance in the interior its coolness and moisture. Thus, immediately facing the ocean, we have the pure ocean climate; and this shades off gradually so as to present

a wonderful variety of climates in close proximity to each other. At least one half the occupied surface of the State enjoys the modified ocean climate.

The ocean climate has no considerable extremes of heat or cold. At San Francisco the lowest temperature for twenty-five years has been 25°, and this is a very rare degree of cold. In the majority of Winters the mercury does not fall below the freezing point. On a few days during the same period it has risen above 90°; and once it reached 98° and 99° on two successive days. These extremes of heat are generally in September, when the sea-breeze is abating.

An idea of the temperature of the climate of San Francisco may be gathered from the fact, that whilst some families have no fire in their houses, Winter or Summer, except for cooking, there are others who pass scarcely a day in the whole year without it. The same clothing is worn in Winter as in Summer. No one thinks of throwing off flannel in July or August. The nights are never warm enough to sit out-of-doors, or to sleep without blankets.

2.—WIND.

More important in regard to health than any other element of the ocean climate is the sea-breeze. It commences in the latter part of February, at first gentle and inconstant, and gradually acquiring force and constancy. The regular sea-breeze of Summer is almost from due west, never north of west, at San Francisco; but in the Spring months there is a tendency northward, and severe northwesterly gales are not uncommon. About the beginning of June the Summer regime is fully established, and the sea-breeze becomes a daily visitor. The mornings, however, are almost invariably calm until ten or eleven o'clock, when the great wave of ocean air comes in. At first it is not unpleasant, but by one or two o'clock it is tempestuous and chilling. From two to five o'clock P. M. it maintains its maximum force. It abates considerably about sunset, and by midnight subsides into a calm. The temperature of the sea-breeze is from 60° to 65° by day, with a minimum of 50° at night; and these figures represent the range of temperature on an ordinary Summer day.

The sea breeze reaches its maximum force in June and July, and is less violent in August. It continues to subside through September and October, and ceases in the beginning of November. After this date the air is calm, except when disturbed for a day or two by a rain storm from the southeast to southwest, or by an occasional dry norther. During the months of November, December, and January, most of the weather is perfectly calm, with a clear sky and a delightful atmosphere; vegetation advances slowly, and the country puts on the garb of Spring.

The sea-breeze, in those sections where it has full play, is the dread of invalids, and the abomination of most residents. After all, however, it has eminent virtues. It invigorates the laborer and infuses strength in every person of active habits; it stimulates the drone and quickens the sluggard; it sweeps away pestilential exhalations and preserves the purity of the atmosphere. Even the invalid may utilize it by a well devised and systematic course of hygiene. Outdoor exercise may always be enjoyed in the calm mornings, whilst in the afternoon it is proper to seek protection in the house. By observing these and other prudential measures which suggest themselves to all sensible persons, the unfavorable influence of the ocean climate may be warded off in a great degree,

and the coolness and purity of the atmosphere made to compensate for every disadvantage.

3.—MOISTURE.

A mistaken idea prevails in regard to the dampness of the climate of San Francisco and the surrounding country. As a general rule there is no mist with the sea-breeze before the middle of June, or later; then it comes in towards evening on a large proportion of the days during three months. But a drying tendency is, nevertheless, observed, and as soon as the supply from the ocean ceases by the subsidence of the wind, the atmosphere drinks up the visible moisture in its lower stratum. Whilst the wind ceases on the earth's surface it continues above, and the mist is carried over in the form of a low cloud. This cloud has an untold value to the interests of California. It flows in during the night, and until the sun dissipates it by its drying influence in the morning, and deposits its moisture on all the highlands and mountains presenting to the west throughout the Pacific slope. To this the redwood tree owes its existence. Without it, the immense forests so essential to the interests of the State would perish. So great is the quantity of moisture supplied by the passing cloud to the intercepting tree, that one may see the water running in streamlets down the towering trunk and forming puddles at its root, and maintaining an annual vegetation where no rain falls, properly speaking, for five or six months of the year.

During the months of December, January, and February, the atmosphere all over California is moist, almost to saturation, except where the north wind prevails. Dense land fogs are occasional. A dead calm exists for most of this period. Hence there is very little evaporation from the soil. But though the air is damp hygrometrically, it does not give the impression of moisture to the sensations. The sky is oftener cloudless for days and weeks together; and the bright sun, genial temperature, and still atmosphere, which prevail in the intervals of the rain, render the Winter climate of California delightful and charming. Strangers coming with their minds occupied by the idea of the "rainy season," are most agreeably disappointed. Only about half the seasons supply rain enough for profitable agriculture. The number of days on which rain falls averages less than sixty in the whole year. In the driest seasons the amount of rain, from one Summer to the next, is but seven or eight inches in the middle section of the State, and much less in the south.

Except on the borders of the ocean, and on the mountain sides where it deposits moisture in a visible form, the sea-breeze has a drying effect. It desiccates the soil with rapidity. Its evaporating power on water in ponds, or in vessels exposed to its action, is really surprising. The arts of domestic life are not disturbed by its moisture. The clothing on the line is dried in an hour—the salt in the cellar never deliquesces—the walls never "sweat." And this is true of all seasons of the year. A napkin wrung out of water and hung in the chamber in the evening, will be found dry in the morning, almost invariably, at all seasons.

On a large scale the drying power of the atmosphere of California is illustrated by the tendency to the absorption of cloud. During the Winter and Spring months, clouds are not wanting, even in a dry season. The upper currents from south and west bring in an ample supply, and the promise of rain is frequent. But farmers whose living depends on the rain, witness with chagrin the clouds absorbed by the thirsty

air, or rolling on over their arid fields, to deposit the moisture, if at all, on the distant mountains. The story of Tantalus is largely realized in California.

Another feature of our climate is the "norther," designated in the southern part of the State as *sand-storms*. These northerly gales occur in the Winter and Spring months, and commonly last three days. They belong to the interior, and are not much felt near the ocean. Sometimes they do mischief by their violence, but their chief evil is the injury to the crops. In the south they are most frequent and severe. Three or four "northers" may occur during the year. Occasionally they sweep the Bay of San Francisco with such force as to damage the shipping. They come on rather suddenly, commencing in the night or forenoon. The air is warm at first, but colder toward the close.

The north winds have a marked relation to the public health, particularly in the Valley of the Sacramento, and in localities farthest removed from the ocean. Invalids suffer from them, and complaint is made of the disturbance and discomfort which they inflict on the population generally. (1) They appear to owe their injurious influence on human health to their extreme aridity, aided possibly by some occult electrical agency.

4.—ELECTRICITY.

The relations of atmospheric electricity to health cannot be estimated. A remarkable absence of sensible electricity exists on this coast. There are at times changes of temperature and rapid formation of clouds, such as might be expected greatly to disturb the electrical equilibrium, but with rare exceptions lightning or thunder is not produced. Three or four times in the year, perhaps, those phenomena occur, mostly in connection with hail. Occasionally, though very seldom, the exhibition approaches the beauty and grandeur of an Atlantic thunderstorm. Nor is it common to witness electrical phenomena artificially excited, for instance, by the friction of clothing. On the whole, there is on this coast an absence of sensible electricity truly remarkable.

GENERAL REMARKS.

From what I have written, the reader will perceive that I regard the *wind* as the most important element of the ocean climate of California. The diurnal range of temperature is never great, but it occurs at that portion of the thermometrical scale which enables the wind to give it painful force. For instance, the morning is calm, with a temperature of 50° to 55° at sunrise; before noon the ordinary maximum of 60° to 67° occurs. With sunshine and calm air, this is just the point of comfort. Now comes the sea-breeze, depressing the mercury to 55° in an hour or two. This depression of six or eight degrees is trifling in itself, but is made chilling in the extreme by the high wind. Temperature alone considered, no more agreeable climate for out-door life could be found in the world than that of San Francisco. So far as it is unfriendly to consumptives or other invalids, the wind alone is at fault. It is never too warm for moderate exercise; and but for the wind, never so cold as to cause chilliness.

(1) An excellent paper on this subject, detailing the noxious influence of the north wind, from the pen of Dr. H. W. Harkness, of Sacramento, was published in the *Pacific Medical and Surgical Journal* for May, 1869.

It is the prevailing belief that the climate of San Francisco is unfavorable to bronchial and pulmonary complaints. Until recently I entertained this opinion; but twenty-five years of observation and experience has modified it considerably. Persons coming to California from the East in quest of a climate which shall arrest the incipient symptoms of consumption, stop in the metropolis until their choice of a permanent sanitarium is made; but they often improve so rapidly as to render it advisable for them to remain, at least till the improvement ceases. I have known quite a number of individuals under these circumstances to regain their health completely. A gentleman within my knowledge, who was subject to occasional attacks of hemoptysis, would always fly from the interior to the city on the first indication of hemorrhage, always finding relief and safety in the tonic climate of the seaboard.

I may be pardoned for referring to my hospital experience on this subject, covering nearly fifteen years—a part of the time in St. Mary's, and the rest in the hospital of the city and county. Consumptive patients are brought to those institutions in all stages of disease, except the initiative, and from all parts of the State. Three fourths of them undergo a marked improvement for a time; and whilst a considerable number have the disease arrested and return to their friends after six months or a year, not a few are restored sufficiently to permit them to leave the hospital and resume their employment. Those who come from the scorching climate of the interior, where the daily temperature is from 90° to 100°, exhibit no ill effects from the change of 30°; but, on the contrary, appear the better for it.

The climate of San Francisco has the reputation of being rapidly exhaustive of nervous power. Men absorbed in business complain of discomfort and debility. They strain every nerve in the exciting pursuit of wealth, day after day and week after week keeping up the tension in the one direction from morning to night, supplying the fancied waste by stimulating draughts, recreating, if at all, in dissipation at unseasonable hours, and after all this wear and tear of the vital machine, they charge on the climate the natural and inevitable results of their own violation of the laws of Nature. So far from the climate being unfavorable in this respect, I think it can be safely averred, that there is no climate in the world which, with proper regard to hygienic laws, enables men to endure more toil of body and mind, and to resist more effectually the ordinary causes of disease, than that of San Francisco and of the coast in general, within the range of the ocean-winds.

CHOICE OF CLIMATE FOR CONSUMPTIVES.

In regard to the choice of climate for invalids coming from the Atlantic States and other regions, it is a great mistake to suppose that any one locality will suit all forms of disease or invalidism. Doubtless some general results can be established; but in their application many exceptions will present. The Winters are mild everywhere in California, except in the mountain regions. But they are milder in the south than elsewhere, and consumptives will therefore find in San Diego, Santa Barbara, Los Angeles, and other localities in the southern counties, the most desirable abode in Winter and early Spring. But in the Summer I believe the bay climate before described is not excelled in sanitary qualities by any other. In the advanced stages of pulmonary disease, it may be well for the patient, whose lease of life is but a question of

time, to select a location and there remain. But this is bad policy in the incipient stages, or when disease is merely threatened. Here the successful pursuit of health requires change and motion; and the best possible programme is to travel from place to place, from ocean to lake, in valley and on mountain, putting to the test the qualities of every location. The chances are, that by the time the health-seeker has determined the most salubrious spot, he will have regained his health.

Although nothing short of actual trial will determine the adaptation of climate or locality in a given case, yet we may often discriminate in regard to patients. Those having rheumatic or neuralgic complications should avoid the sea-board. So should those who are sensitive to cold, and whose hands and feet lose their temperature on slight exposure. On the contrary, when cold induces prompt reaction and has no chilling effect—when exposure induces a speedy glow of the surface—in other words, when there is an abundant supply of animal heat, the ocean climate is likely to be best adapted.

There are two opposite courses of hygienic treatment appropriate to consumptives—an outdoor life on the one hand, and housing and protection on the other. Up to a given point in the progress of each case the former is applicable; after that the latter. There is no proper medium. As soon as the patient ceases to be able to live almost wholly in the open air, domestic comfort must be diligently sought. In the ocean climate particularly, fire should be kindled on the hearth morning and evening.

ADVICE TO CONSUMPTIVES.

It is now a well-established principle in therapeutics, that an outdoor life, for those predisposed to phthisis, or in the incipient stage, is prophylactic and curative beyond any other course. Owing to the absence of rain for six months of the year, and the small number of rainy days in the other six months, California furnishes opportunities for carrying out this plan almost unrivaled in any other country.

"*Camping out*" is getting to be a common practice with invalids. A party is formed, and some mountain nook or other desirable spot is selected, where, with tents and simple bedding and cooking utensils, the company spend their time in fishing and hunting and recreation of all kinds; and if, happily, they are provided with the intellectual means, in the practical study of the charming Book of Nature. Not only do consumptives in the early stages of disease—in the early stages alone, however—encounter with safety the exposure, but they almost invariably improve in health and strength.

I regard this subject as of great importance, and well worthy of more attention than has hitherto been conceded to it by the profession. Having been applied to frequently by letter from the Atlantic States, and personally by visitors seeking a health resort on this coast, to escape from threatened pulmonary disorder, and having in former years recommended such applicants to towns and settlements in the interior or in the south, I have more recently adopted what has certainly proved to be a better course, and which is embodied in the following instructions:

"Set out and seek for yourself the place you want. If you are able to ride in the saddle, be sure and do so every day, wherever you are. Stop at a place only as long as your health improves. Buy a horse or a mule, mount him, and strike out through the country, over vale and mountain, on an exploring expedition. If the weather is hot, use the early morning, and lay by from the hot sun, or for other good cause. Keep moving, up to the point of endurance. Eat anything your appetite craves. Accustom yourself to rough, wholesome fare. Drink all the milk you can, and if you can't get milk, drink cream. "Avoid all spirituous and fermented drinks, especially if you have an appetite for food or milk. Always wear flannel next the skin. Never omit the daily worship of Cloacina."

RELATION OF PHTHISIS TO RACE AND NATIONALITY.

The mortuary statistics of San Francisco, as compiled by the Health Officer, Dr. Henry Gibbons, Jr., and published in his annual report, show five hundred and sixteen deaths from phthisis in the year ending June, eighteen hundred and seventy-five, exclusive of Chinese, from whom no authentic returns can be procured. Of this number there were: Born in California, fifty-two; born in the Atlantic States, one hundred and thirty; born in foreign countries, three hundred and thirty-two; unknown, two. That is to say, only one fourth of the decedents from phthisis were Americans, so called, for the fifty-two born in California were of the Spanish and Indian races. The proportion of American adults to foreigners, in the population of San Francisco, is about two to three, so that if the Americans had suffered from the disease as much as foreigners, the figures would stand thus: Deaths among Americans, one hundred and eighty-five; deaths among foreigners, two hundred and seventy-three. If we extend the inquiry, to ascertain what foreign nationality has suffered most, we shall find a remarkable disparity to the prejudice of the Irish race, which, with about one half the foreign population, furnishes two thirds of the deaths in that population. Though these results are not exact, yet I am confident that they are not far from the truth. I do not hesitate to assert that, in San Francisco, there is much less tendency to pulmonary consumption in the native Anglo-Saxon stock than in any of the foreign races. In hospital practice this is well marked, and in my own private practice it has been not less so. I have taken the pains to inquire among my brother practitioners, who very generally unite with me in the belief that *phthisis seldom originates in the climate of San Francisco among the American population.* A large proportion of the deaths of Americans have been of individuals who have left their Atlantic homes after the development of the disease.

But why should the Irish people suffer so fearfully from this cause? Not on account of poverty and want, for there is not a city in the world where the laboring classes are so well housed, so well clothed, and so well fed as in San Francisco. A large proportion of them own their homes, and enjoy the comforts and luxuries of life to a rare extent.

There is more reason for ascribing the prevalence of phthisis among the Irish people to the very opposite condition, namely, the change from the rugged and comparatively out-door life of their native country to the ease and indulgence of a higher civilization. It is a well-known fact that the aborigines of this coast, when transplanted from their wigwams to American homes, become sensitive and liable to disease, and their diseases tend to the lungs and are rapidly fatal. Again, it is observed that whilst the inhabitants of cities may plunge with im-

punity into the rugged life of the mining camp, a return from "roughing it" to the luxuries of a city home is fraught with danger.

In the estimation of some writers, the Irish, as a race, are prone to phthisis. Perhaps the tendency is increased by the very general habit of their females to indulge in strong drink. There is no nationality in which both sexes are so addicted to this practice; at least such was formerly the case, though a great and a blessed change is in progress among them, through the agency of their temperance associations.

I may be permitted another remark on this topic. If there were any prophylactic virtue in whisky as against phthisis, the Irish people ought to exhibit a marked exemption from that malady.

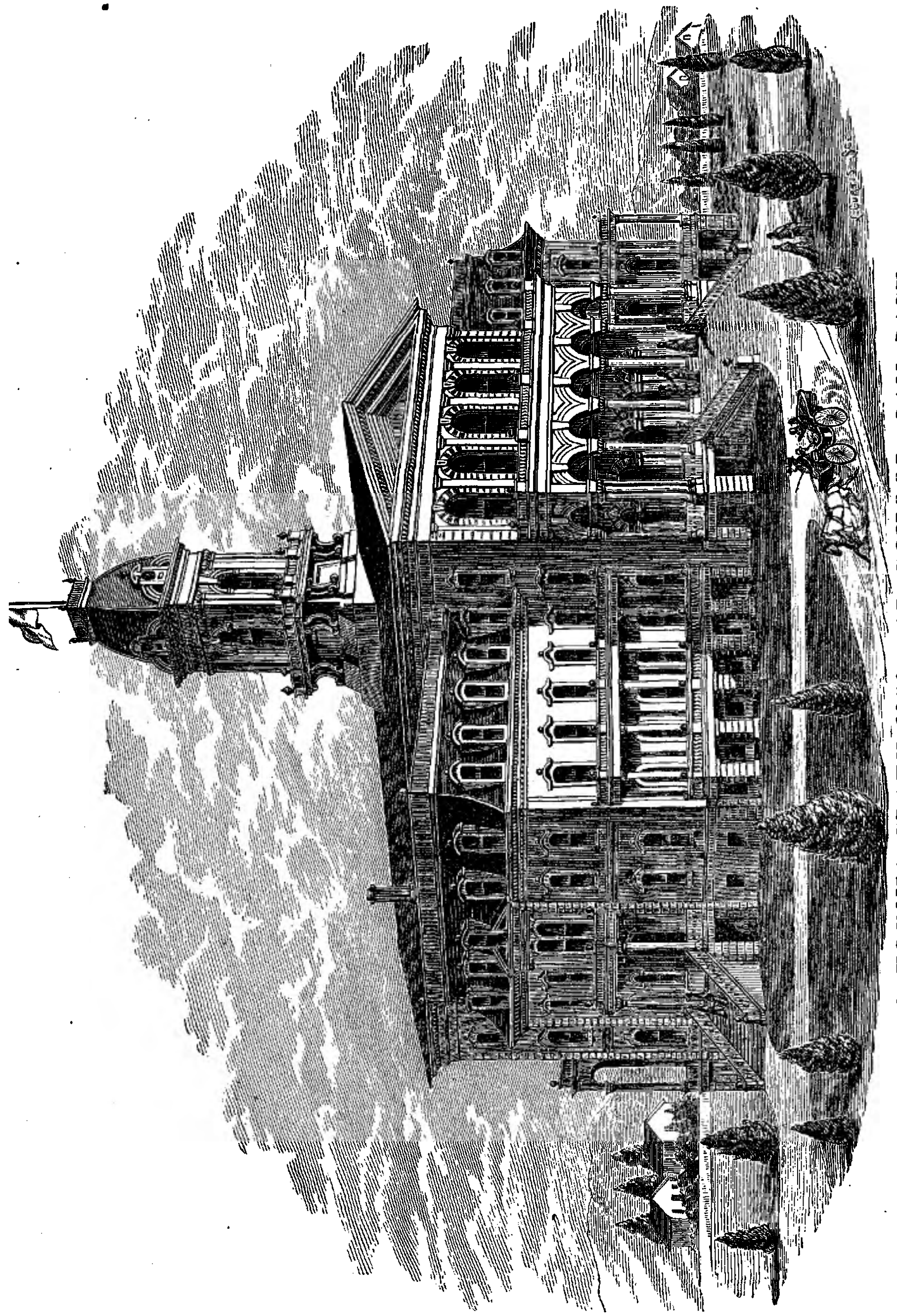
THE EPIZOOTICS OF 1873 AND 1875.

In 1873, and now again in 1875, an *equine influenza* marched across the continent from the Atlantic to the Pacific Ocean. In 1873 it approached in two directions—from Texas, through Arizona, on the south, and northward by the great route of travel through Utah and Nevada. In the present year it descended on this coast in an universal shower, without noticeable approaches. The only epidemic of which we have any knowledge as having crossed the continent previously, was the malignant cholera of 1850, which pursued nearly the same course as the epizoon of 1873, though less distinctly marked in its advance and less rapid in its march.

To those who regard the winds as the means of wafting the seeds of epidemic disease, a fact of some interest presents itself for consideration. At the time of the march of the horse plague over the Sierras and its precipitation on the western slope, a constant current of air was sweeping from the ocean in the direction exactly opposite. Not only did this great atmospheric wave occupy the lower stratum of air in contact with the earth's surface, but it extended upwards to the region of the cirrhus clouds, as their course from day to day demonstrated. Perhaps there is no point on the globe, in the region of population and civilization, where a deeper and more uninterrupted current of air sweeps in a more uniform course. And it was in the teeth of this wave that the epizootic sped on swift wing across the Sierras, and from the mountains to the sea.

The epidemics under consideration derive a special interest from their evident relation to human health. For two years prior to 1873, our State had enjoyed a remarkable exemption from disease. But simultaneously with the accession of the horse influenza, or rather in anticipation of it, a general tendency to eruptive and contagious disorders was manifested, particularly among children. Measels, whooping-cough, and scarlatina were developed quite suddenly in all directions. For the first time on the Pacific Coast, cerebro-spinal meningitis appeared as an endemic, invading a few localities in the northern section of the State.

The relation of cattle plagues to human health is a question of great importance. Comparative anatomy and physiology have thrown much light on the anatomy and physiology of man; and it will scarcely be doubted that comparative pathology and epidemiology can be made to serve a similar useful purpose. The interests of medical science demand a complete history of the epidemics of 1873 and 1875, particularly the former, from some competent member of our profession in the Atlantic States, where the sources of information abound.



CALIFORNIA STATE NORMAL SCHOOL, SAN JOSE.

SIXTH BIENNIAL REPORT

OF THE

Superintendent of Public Instruction

OF THE

STATE OF CALIFORNIA,

FOR THE

SCHOOL YEARS 1874 AND 1875.

SACRAMENTO:
G. H. SPRINGER, STATE PRINTER.
1875.

DEPARTMENT OF PUBLIC INSTRUCTION,
SACRAMENTO, November 1st, 1875.

To His Excellency,
ROMUALDO PACHECO,
Governor of California:

SIR: In accordance with the provisions of subdivisions two and three of section fifteen hundred and thirty-two of the Political Code, I have the honor herewith to submit to your Excellency the Sixth Biennial Report of the Superintendent of Public Instruction, for the school years ending June thirtieth, eighteen hundred and seventy-four and eighteen hundred and seventy-five.

Very respectfully, your obedient servant,

HENRY N. BOLANDER,
Superintendent of Public Instruction.

REPORT.

INTRODUCTION.

Since my last report, twenty-nine thousand nine hundred and fifty-three children have been added to our school population; one hundred and seventeen new school districts, supporting three hundred and twenty-two schools, have been organized; two hundred and seventy-four new school houses have been built and furnished, and old school houses refurnished, at a cost of six hundred and thirteen thousand seven hundred and forty six dollars and sixty-one cents; the school expenditures have been increased by five hundred and forty-four thousand eight hundred and eighty-five dollars and nine cents; the school property has increased in worth one million eleven thousand two hundred and sixty-two dollars and eighty-five cents; the average school terms have been lengthened 1.33 months, being now 7.47 months as against 6.14 months in eighteen hundred and seventy-three; thirty-four districts as against four hundred and sixty-four in eighteen hundred and seventy-three, maintained school less than six months; seven hundred and sixty-five districts, as against three hundred and sixty-one in eighteen hundred and seventy-three, maintained school more than six months; and seven hundred and eighty-seven districts, as against six hundred and thirty-seven in eighteen hundred and seventy-three, maintained school eight months and over.

On the other hand, there is a decrease of .82 per cent in the enrollment of census children in public schools; a decrease of 5.18 per cent in the average number of census children belonging to public schools; a decrease of 3.93 per cent in the number of census children in daily attendance at public schools; and an increase of .91 per cent in the number of census children who do not attend school during the school year. Again, while the total number of children—including those over seventeen years of age—who have attended public schools at any time during the school year, is twenty-three thousand three hundred and thirty-seven more than in eighteen hundred and seventy-three, yet the *average* number belonging, *i. e.* children who attend school long enough that they can be considered as *pupils*, is increased by only eight thousand two hundred and forty-two; and the average daily attendance is increased by only eight thousand five hundred and sixty-six!

In relief to this showing of our educational statistics, I must note a great advance in the number of first grade schools, *i. e.*, high schools, grammar schools, and schools in which high school and grammar grade studies are taught in addition to the lower grade studies; the greater number of teachers holding high grade certificates; in the better salaries paid to lady teachers; in the greater amount of funds spent for school apparatus, one half of our districts being now supplied, at least partly, with apparatus. Much remains yet to be done, however, in the equipment of school houses; for one fifth of our districts have not yet even the outhouses demanded by decency; three fourths of the districts have not suitably improved school grounds; one half of the districts do not furnish their schools with the necessary apparatus; and nearly one half of the districts have not furnished their school-rooms with improved furniture.

On the whole, however, the statistical exhibits are very satisfactory and encouraging. There are limits beyond which statistics cannot go. To paraphrase a saying of Napoleon I, "Statistics mean the keeping of an exact account of the cost of education;" but no statistics will show the educational outcome realized from our system. It is, therefore, not strange, that whilst our statistics show remarkable progress, there is, on the other hand, a very general impression abroad, that in the vital part of our system—the education of our children—there is no progress, and that no progress is possible until a radical change has been made in our system of education. I have, therefore, devoted considerable space to the discussion of the changes, as I see them, necessary to be made in our system of instruction. I have done more; I have for very many subjects given an extended description of the method of handling the subject. The opinion gains daily more ground, that an educational report should, in addition to the necessary statistics, give an account of the education demanded by the wants of the age; the correct methods of handling the different subjects of instruction; in short, that a report should be a hand-book for educators. Hence it will be found that our State reports leave the more or less sterile discussion of statistics, and turn their attention more and more to the internal economy of our schools: the qualification of our teachers; the subjects of study taught, and the manner of teaching them; the text-books required; the adapting of our instruction to the every-day wants of life; etc.

STATISTICAL SUMMARIES.

The actual and comparative condition and progress of the pul schools of California, for the two years commencing July first, eight hundred and seventy-three, and ending June thirtieth, eighteen hund and seventy-five, may be summarized as follows:

I.—Census Statistics.

(*a.*) *Enumeration of Children.*

	1874.	1875.
Number of white boys between the ages of 5 and 17	79,820	85,76
Number of white girls between the ages of 5 and 17	77,691	83,62
Number of white children between the ages of 5 and 17	157,511	169,38
Number of white children between the ages of 5 and 15 in 1873	....	139,59
Increase	....	29,78
Number of negro boys between the ages of 5 and 17	580	575
Number of negro girls between the ages of 5 and 17	484	492
Number of negro children between the ages of 5 and 17	1,064	1,067
Number of negro children between the ages of 5 and 15 in 1873	....	914
Increase	....	123
Number of Indian boys between the ages of 5 and 17	694	629
Number of Indian girls between the ages of 5 and 17	448	484
Number of Indian children between the ages of 5 and 17	1,142	1,113
Number of Indian children between the ages of 5 and 15 in 1873	....	1,070
Increase	....	43

	1874.	1875.
Total number of census children between the ages of 5 and 17....................................	159,717	171,563
Total number of census children between the ages of 5 and 15 in 1873..........................	....	141,610
Increase..	....	29,953
Number of white children under 5 years of age..	74,322	78,003
Number of negro children under 5 years of age..	348	385
Number of Indian children under 5 years of age.	206	262
Total number of children under 5 years of age...	74,876	78,650
Total number of children under 5 years of age in 1873...	....	70,086
Increase.........................	....	8,564

The last Legislature changed the age of census children. From eighteen hundred and sixty-six to eighteen hundred and seventy-four, the Census Marshals listed the children between five and fifteen years of age; since then, the children between five and seventeen years of age. A direct comparison of the census statistics of eighteen hundred and seventy four, with the statistics of previous years, is, therefore, not possible, as the increase for eighteen hundred and seventy-four includes the increase of children between five and fifteen years of age, and the number of children between fifteen and seventeen years of age.

Comparing the census statistics of eighteen hundred and seventy-four with those of eighteen hundred and seventy-five, it will be found that the increase—eleven thousand eight hundred and forty-six, or nearly 7.42 per cent—is abnormally large. The large immigration which poured into the State during the Spring of eighteen hundred and seventy-five, must have largely added to our school population. The percentage of increase for previous years, stands as follows:

From 1866 to 1867, 10.80 per cent.
From 1867 to 1868, 8.30 per cent.
From 1868 to 1869, 8 28 per cent.
From 1869 to 1870, 10.04 per cent.
From 1870 to 1871, 6.84 per cent.
From 1871 to 1872, 5.56 per cent.
From 1872 to 1873, 3.10 per cent.
From 1873 to 1874, no comparison possible.
From 1874 to 1875, 7.42 per cent.

(b.) *School Attendance of Census Children.*

(1.)—AT PUBLIC SCHOOLS.

	1874.	1875.
Number of white children who have attended public schools at any time during the school year	105,107	115,983
Number of negro children who have attended public schools at any time during the school year	614	657
Number of Indian children who have attended public schools at any time during the school year	169	256
Total number of census children who have attended public schools at any time during the school year..	105,890	116,896
Average number of census children belonging to public schools..	70,279	77,350
Average daily attendance of census children......	63,651	69,658
Percentage of total number enrolled................	66.29	68.14
Percentage of total number enrolled in 1873......	....	68.96
Decrease, equivalent to 1,407 census children for 1875..	....	.82
Percentage of average number belonging..........	44.00	45.08
Percentage of average number belonging in 1873..	....	50.26
Decrease, equivalent to 8,887 census children for 1875..	....	5.18
Percentage of daily attendance........................	39.85	40.60
Percentage of daily attendance in 1873............	....	44.53
Decrease, equivalent to 6,742 census children for 1875..	....	3.93

In other words, from July first, eighteen hundred and seventy-four, to June thirtieth, eighteen hundred and seventy-five, one hundred and sixteen thousand eight hundred and ninety-six census children were enrolled in the public schools of this State; but only seventy-seven thousand three hundred and fifty census children—*i. e.*, the average number of census children belonging to public schools—can be considered as having been actual pupils of the public schools; and only sixty-nine thousand six hundred and fifty-eight census children were in daily attendance during the whole time schools were maintained.

From the following table, it will appear that since eighteen hundred and seventy-two, the percentage of census children which can be considered as actual pupils of our public schools, has considerably decreased; the number in daily attendance has also decreased; and we have since eighteen hundred and seventy-three, even a decrease in the percentage of census children enrolled in the public schools:

Year.	Listed on census.........	Enrolled in public schools.......	Percentage enrolled	Average number belonging to public schools...	Percentage	Average daily attendance.........	Percentage.........
1866............	85,152	37,906	44.51	28,232	33.15	....	....
1867............	94,349	54,726	58.00	41,411	43.89	....	....
1868............	102,183	60,946	59.64	45,667	44.69	....	....
1869............	110,642	67,834	61.31	52,168	47.15	....	....
1870............	121,751	70,030	57.44	50,155	41.19	....	....
1871............	130,116	83,628	64.27	65,949	50.68	....	....
1872............	137,351	92,255	67.55	71,481	52.04	64,375	46.86
1873............	141,610	97,681	68.96	71,170	50.26	63,063	44.53
1874............	159,717	105,890	66.29	70,279	44.00	63,651	39.85
1875............	171,563	116,896	68.14	77,350	45.08	69,658	40.60

(2.)—AT PRIVATE SCHOOLS.

	1874.	1875.
Number of white census children who have attended only private schools at any time during the school year	14,052	14,939
Number of negro census children who have attended only private schools at any time during the school year	78	64
Number of Indian census children who have attended only private schools at any time during the school year	19	18
Total number of census children who have attended only private schools at any time during the school year............	14,149	15,021
Percentage of census children who have attended only private schools.......	8.86	8.75
Percentage of census children who have attended only private schools in 1873............	....	8.84
Decrease, equivalent to 154 census children for 1875.	....	.09

In my last report, I called attention to the steady decrease in the nu ber of census children in attendance at private schools. In eighte hundred and sixty-six, 29.92 per cent of the census children attend private schools; in eighteen hundred and seventy-five, only 8.75 p cent.

Year.	Listed on census.........	Enrolled in private schools...	Percentag
1866	85,152	25,475	29.9
1867	94,349	18,182	19.3
1868	102,183	17,654	17.2
1869	110,642	17,344	15.6
1870	121,751	24,654	20.3
1871	130,116	17,029	13.5
1872	137,351	13,787	10.0
1873	141,610	12,507	8.8
1874	159,717	14,149	8.8
1875	171,563	15,021	8.7

(3.)—AT NO SCHOOLS.

	1874.	1875.
Number of white census children who have attended no school during the school year........	38,514	38,461
Number of negro census children who have attended no school during the school year........	353	346
Number of Indian census children who have attended no school during the school year.........	811	839
Total number of census children who have attended no school during the school year.........	39,678	39,646
Percentage of census children who have attended no school during the school year.........	24.84	23.11
Percentage of census children who have attended no school during the school year in 1873..	....	22.20
Increase equivalent to 1,561 census children for 1875.........	....	.91

Since eighteen hundred and sixty-six, the non-attendance of census children has been as follows:

Year.	Listed on census.	Attended no school.	Percentage.
1866	85,152	21,771	25.57
1867	94,349	21,441	22.62
1868	102,183	23,583	23.08
1869	110,642	25,464	23.01
1870	121,751	27,067	22.23
1871	130,116	29,459	22.64
1872	137,351	30,780	22.41
1873	141,610	31,422	22.19
1874	159,717	39,678	24.84
1875	171,563	39,646	23.11

TO RECAPITULATE:

	1874.	1875.
Total number of census children who have attended public schools at any time during the school year	105,890	116,896
Total number of census children who have attended only private schools at any time during the school year	14,149	15,021
Total number of census children who have attended no school during the school year	39,678	39,646
Percentage of census children enrolled in public schools	66.29	68.13
Percentage of census children enrolled in private schools	8.86	8 75
Percentage of census children attending no school	24.85	23.12

But, in order to obtain a correct estimate of the attendance at school of census children, we must take the average number belonging—that is, the number of children who can be considered as actual pupils of the public schools—instead of the total number enrolled, as in this number are included all those who attend for so short a time—sometimes only for a day, or at longest for a week—that they cannot be classed as pupils of the public schools. The real school attendance will then stand:

	1874.	1875.
Number of census children attending public schools	70,279	77,35
Number of census children attending private schools	14,149	15,021
Number of census children attending no schools	75,289	79,192
Percentage of census children attending public schools	44.00	45.08
Percentage of census children attending private schools	8.86	8.75
Percentage of census children attending no school	47.14	46.27

(c.) *Nativity of Census Children.*

For eighteen hundred and seventy-four, the Census Marshals reported the nativity of 224,633 children not more than seventeen years of age. According to these reports, we had in this State, in eighteen hundred and seventy-four:

109,742 native-born children, both parents native born;
24,207 native-born children, one parent foreign born;
85,887 native-born children, both parents foreign born;
4,797 foreign-born children.

Or, expressed in percentages, in eighteen hundred and seventy-four:

48.85 per cent of our children were of native-born parents;
10.78 per cent of our children had one foreign-born parent;
40.37 per cent of our children were of foreign parents.

For eighteen hundred and seventy-five, the Census Marshals reported the nativity of 252,301 children not more than seventeen years of age. Their nativity stands:

125,119 native born, both parents native;
26,962 native born, one parent foreign born;
93,776 native born, both parents foreign born;
6,444 foreign born.

Or, expressed in percentages, in eighteen hundred and seventy-five:

49.59 per cent of our children were of native-born parents;
10.68 per cent of our children had one foreign-born parent;
39.73 per cent of our children were of foreign parents.

II.—SCHOOL STATISTICS.

	1874.	1875.
(a.) Number of Districts and Schools.		
Total number of school districts	1,512	1,579
Total number of school districts in 1873	.....	1,462
Increase	.....	117
Number of first grade schools	718	875
Number of first grade schools in 1873	.....	465
Increase	.....	410
Number of second grade schools	737	770
Number of second grade schools in 1873	.....	761
Increase	.....	9
Number of third grade schools	550	545
Number of third grade schools in 1873	.....	642
Decrease	.....	97
Total number of schools	2,005	2,190
Total number of schools in 1873	.....	1,868
Increase	.....	322

Under "first grade schools" are included high schools, grammar schools, and first grade schools, *i. e.*, schools in which some pupils are in the first grade. Under "second grade schools" are included intermediate schools, and second grade schools, *i. e.*, schools in which no pupil pursues studies beyond the second grade. Under "third grade schools" are included primary schools, and third grade schools, *i. e.*, schools in which no pupil pursues studies beyond the third grade.

	1874.	1875.
(b.) School Attendance.		
Whole number of boys enrolled on Register	63,138	68,493
Whole number of girls enrolled on Register	57,102	62,437
Total number enrolled	120,240	130,930
Total number enrolled in 1873	.....	107,593
Increase	.....	23,337
Average number belonging	79,807	86,637
Average number belonging in 1873	.....	78,395
Increase	.....	8,242
Average daily attendance	72,283	78,027
Average daily attendance in 1873	.....	69,461
Increase	.....	8,566

	1874.	1875.
Number enrolled in High Schools, or the Advanced Grade	2,447	3,24
Number enrolled in Grammar, or First Grade Schools	12,645	16,17
Number enrolled in Intermediate, or Second Grade Schools	25,675	30,82
Number enrolled in Primary, or Third Grade Schools	67,288	79,53
Percentage of pupils in High Schools	2.26	2.5
Percentage of pupils in Grammar, or First Grade Schools	11.69	12.4
Percentage of pupils in Intermediate, or Second Grade Schools	23.76	23.95
Percentage of pupils in Primary, or Third Grade Schools	62.29	61.28
(c.) Length of School Terms.		
Districts maintaining school less than six months	568	34
Districts maintaining school less than six months in 1873	.....	464
Decrease	.....	430
Districts maintaining school six months or over, but less than eight months	412	765
Districts maintaining school six months or over, but less than eight months in 1873	.....	361
Increase	.....	404
Districts maintaining schools eight months or over	533	787
Districts maintaining schools eight months or over in 1873	.....	637
Increase	.....	150
Average number of months schools were maintained, for all the schools of the State	6.34	7.47
Average number of months schools were maintained, for all the schools of the State in 1873	.....	6.14
Increase	.....	1.33
Districts having not sufficient funds for an eight months school	.....	924
(d.) Teachers.		
Number of male teachers	957	1,033
Number of male teachers in 1873	.....	882
Increase	.....	151
Number of female teachers	1,495	1,660
Number of female teachers in 1873	.....	1,454
Increase	.....	206
Total number of teachers	2,452	2,693
Total number of teachers in 1873	.....	2,336
Increase	.....	357
Number of teachers holding first grade certificates, including life and educational diplomas	1,287	1,485
Number of teachers holding second grade certificates	763	802
Number of teachers holding third grade certificates	402	406

	1874.	1875.
Average monthly salary paid to male teachers	$83 82	$84 93
Average monthly salary paid to male teachers in 1873		84 28
Increase		$ 65
Average monthly salary paid to female teachers	$65 20	$68 01
Average monthly salary paid to female teachers in 1873		63 37
Increase		$4 64
Teachers who have taught in the same school more than one year	329	460
Number of teachers who attended County Institutes	969	1,494
Number of teachers who subscribed for some educational journal	584	669
Number of teachers who are graduates of the California State Normal School	248	241
Number of teachers who are graduates of any State Normal School	264	275
(e.) County Superintendents.		
Number of school visits made by County Superintendents	2,969	3,621
Number of school visits made by County Superintendents in 1873		2,046
Increase		1,575
Number of Trustees appointed by County Superintendents	921	1,186
Number of Trustees appointed by County Superintendents in 1873		926
Increase		260
Number of certificates granted to male teachers	333	431
Number of certificates granted to female teachers	703	952
Number of applicants rejected	681	1,083
Number of certificates renewed	326	164
Amount of salaries paid County Superintendents	$43,390 00	$43,622 00
Amount of salaries paid County Superintendents in 1873		40,170 00
Increase		$3,452 00
Average annual salary paid County Superintendents	$867 80	$838 89
Average annual salary paid County Superintendents in 1873		803 40
Increase		$35 49
(f.) Miscellaneous School Statistics.		
Number of new school houses erected	99	175
Number of new school houses erected in 1873		126
Increase		49

	1874.	1875.
Districts having suitable accommodations for all pupils who may wish to attend school	1,146	1,320
Districts not having suitable accommodations for all pupils who may wish to attend school	382	324
Districts whose schools are provided with water-closets	1,217	1,295
Districts whose schools are not provided with water-closets	321	329
Districts having sufficient school grounds	1,370	1,509
Districts not having sufficient school grounds	118	112
Districts whose school grounds are suitably improved	369	411
Districts whose school grounds are not suitably improved	1,159	1,220
Districts whose schools are well ventilated	1,443	1,553
Districts whose schools are not well ventilated	86	66
Districts whose schools are supplied with good furniture	531	621
Districts whose schools are supplied with passable furniture	292	416
Districts whose schools are supplied with poor furniture	700	604
Districts whose schools are well supplied with apparatus	296	382
Districts whose schools are passably supplied with apparatus	312	501
Districts whose schools are poorly supplied with apparatus	924	763
Number of schools for colored children	23	19
Number of schools for colored children in 1873		22
Decrease		3
Number of pupils attending schools for colored children	448	339
Number of pupils attending schools for colored children in 1873		414
Decrease		75
Number of school visits made by County Superintendents	2,969	3,621
Number of school visits made by County Superintendents in 1873		2,046
Increase		1,575
Number of school visits made by Trustees	7,654	8,944
Number of school visits made by other persons	48,113	51,839

III.—Financial Statistics.

	1874.	1875.
(a.) Receipts.		
Balance on hand at the beginning of the school year	$405,986 55	$387,761 11
Received from State apportionments	427,157 89	1,210,808 49
Received from county apportionments	1,332,208 82	1,115,530 06
Received from city and district taxes	235,821 09	315,682 66
Received from miscellaneous sources (sale of bonds, rents, etc.)	109,495 86	360,576 98
Total receipts from all sources	$2,510,670 21	$3,390,359 30

	1874.	1875.
Percentage of School Funds from State apportionments.....	17.01	35.71
Percentage of School Funds from County apportionments..	53.06	32.90
Percentage of School Funds from other sources..............	29.93	31.39
Increase since 1873, in receipts from State apportionments, 22.77 per cent..........	....	$780,588 89
In receipts from miscellaneous sources.........	....	50,074 68
In total receipts from all sources.........	....	838,580 23
Decrease since 1873, in receipts from county apportionments, 13.36 per cent..........	....	63,542 39
In receipts from city and district taxes.........	....	46,842 39
Amount of State apportionments per census child....	3.05	7.59
Amount of State apportionments per census child in 1873..	....	3.18
Increase	....	4.41
Amount of county apportionments per census child...........	8.34	6.44
Amount of county apportionments per census child in 1873.	....	7.31
Decrease.........	....	.87
Total receipts of all kinds per census child.........	15.72	19.76
Total receipts of all kinds per census child in 1873.........	....	18.02
Increase	....	1.74
(b.) Expenditures for School Purposes.		
Amount paid for teachers' salaries.........	$1,560,830 16	$1,810,479 62
Amount paid for rent, repairs, fuel, and contingent expenses	331,952 30	381,806 62
Amount paid for school libraries.........	21,752 82	33,962 72
Amount paid for school apparatus.........	4,152 80	10,713 02
Total current expenses.........	$1,918,688 08	$2,236,961 98
Amount paid for sites, buildings, and school furniture.........	192,467 25	421,279 36
Total expenditures of all kinds.........	$2,111,155 33	$2,658,241 34
Percentage of current expenses paid for teachers' salaries...	81.35	80 93
Percentage of current expenses paid for contingent expenses, etc.........	17.30	17.07
Percentage of current expenses paid for school libraries.....	1.13	1.52
Percentage of current expenses paid for school apparatus...	.22	.48
Increase since 1873 in amount paid for teachers' salaries....	....	$376,112 69
In amount paid for contingent expenses, etc.........	....	106,131 91
In amount paid for libraries.........	....	9,083 24
In amount paid for school apparatus.........	....	6,347 32
In total current expenses.........	....	497,675 16
In expenditures for sites, buildings, and school furniture....	....	31,120 86
In total expenditures of all kinds.........	....	544,885 09
Cost of tuition per scholar enrolled in public schools during the year.........	$12.98	$13.83
Cost of tuition per scholar in average attendance.........	19.56	20.89
Cost of tuition per scholar in daily attendance.........	21.59	23.20

	1874.	1875.
Total cost (current expenses) per scholar enrolled in public schools during the year.........	$15.95	$17.0
Total cost per scholar in average attendance.........	24.04	25.8
Total cost per scholar in daily attendance.........	26.54	28.6
(c.) Expenditures from Unapportioned County School Fund.		
Cash drawn for County Institutes.........	$2,157 60	$2,936 4
Cash drawn for County Boards of Examination.........	10,108 73	12,396 6
Cash drawn for postage, stationery, etc.........	2,468 21	4,163 2
Total expenditures from unapportioned County School Fund.........	$14,734 54	$19,496 3
Total expenditures from unapportioned County School Fund for 1873.........	....	14,805 9
Increase	....	$4,690 3
(d.) Valuation of School Property.		
Valuation of sites, school houses, and furniture.........	$4,269,884 35	$4,879,328 3
Valuation of school libraries.........	127,566 13	138,564 6
Valuation of school apparatus.........	38,691 79	50,785 2
Total valuation of school property.........	$4,436,142 27	$5,068,678 3
Total valuation of school property in 1873.........	....	4,057,415 4
Increase	....	$1,011,262 8

PROGRESS.

Since the school year, ending June thirtieth, eighteen hundred anc sixty-seven, no greater progress has been made in popular education ir California than during the school year ending June thirtieth, eighteer hundred and seventy-five. From July first, eighteen hundred and sixty-six, to June thirtieth, eighteen hundred and sixty-seven, for the firsl time in the history of the State, every public school was made entirely free for every child; and an important transition was thereby marked in popular education. But, though every public school was made free, the ways and means provided for the public schools, and the manner oi apportioning these means to the different districts, were for years such that only in the centers of wealth and population the children had sufficient facilities for obtaining a good common school education, whilst in all other sections of the State the school system was but a pretense for popular education. The system went further, for in some cases it even thrust districts from without its pale. Hundreds of districts did not receive sufficient funds to maintain in every year the three months' school guaranteed by the Constitution to every district of the State. Up to June thirtieth, eighteen hundred and seventy-four, districts whose number of census children fell below a certain figure—twenty for some counties, up to as high as thirty for others—did not receive for any one

school year sufficient funds to maintain a three months' school for that year.

Thanks to the last Legislature, however, for the school year ending June thirtieth, eighteen hundred and seventy-five, and for the first time in the history of this State, every district received sufficient funds for not only a three months' school, but for at least a six months' school. The progress thereby made in popular education can hardly be over estimated. Short school terms—which, until last year, have been the rule and not the exception in a majority of the districts of the State—place within the reach of our children only such fragmentary bites of instruction which are only a little better than none at all. Every system of popular education which does not insure to every district of the State at least an eight months' school every year, is but a sham. Long school terms are the *sine qua non* without which it is impossible to give our children the full measure of the amount and quality of education needed by them. Happily, the wise action of the last Legislature has secured to our schools this first factor in every successful system of popular education. The results of this action are patent. In eighteen hundred and seventy-three, only 43.3 per cent of all the districts maintained an eight months' school; in eighteen hundred and seventy-five, this percentage is raised to 49.53; in eighteen hundred and seventy-two, over four hundred and sixty-four districts, or 31.74 per cent did not keep a six months' school; in eighteen hundred and seventy-five, the number has diminished to 34, or 2.15 per cent of all the districts in the State. In other words, all but thirty-four districts maintained at least a six months' school.

This unprecedented advance in the popular education of our State is due to two causes: First, the munificence of the last Legislature in more than quadrupling the amount of school money to be raised by State tax; and, second, the change made in the manner of apportioning the School Fund among the districts. This I shall now consider.

THE NEW METHOD OF APPORTIONING SCHOOL MONEY.

In my last report I pointed out that the time-honored method of apportioning school moneys pro rata, according to the number of census children, must always discriminate most unjustly against the thinly populated districts of the State. In bringing this matter to the attention of the Legislature, I used the following language:

"The law [in 1873] is faulty, not so much primarily, by not providing sufficient funds, as by not providing for an equitable apportioning of the funds. At present the State and county school funds are apportioned to the school districts, not in proportion to the needs of each district, but in proportion to the number of census children. The number of census children belonging to a district determines the amount of funds apportioned to the district; but, within a certain limit, the number of census children does *not* determine the expenses of maintaining a public school. Thus one district may have fifteen census children, another fifty; still the same amount is needed by each district to maintain a school for a definite length of time. Yet the former district may not obtain enough funds for a three months' school, while the latter district perhaps receives enough funds for an eight months' school. To give a specific example: In Solano County, where the total amount per census child of State and County School Funds was last year, in round figures, sixteen dollars, a district with fifteen census children received two hundred and forty dollars—just enough for a four months' school, if the money was used exclusively for the payment of the teacher's salary, and this salary did not exceed sixty dollars per month. The district having fifty children received eight hundred dollars—sufficient for an eight months', yes, a ten months' school, besides enabling the district to employ a better teacher by paying a better salary, to make some repairs and improvements, or to make some additions to the apparatus or the library, if needed—things which were placed within the reach of the former district only by means of voting a special tax. In short, the longest terms, the best schools, the best teachers, the best and most complete furniture, apparatus, and library, are given to the district having a sufficient number of census children; whilst a district wanting these is proportionally curtailed in its educational facilities. Now, except there is an inherent right in numbers to warrant it, such discrimination is a blot upon our school system, and should, if possible, immediately be removed, or our system fails in the object by reason of which alone it can claim our recognition and support: the free and equal education of *all* the children of the State, irrespective of the standing in society, or the residence of their parents.

"On first sight, it might seem that increased taxation would be the most expeditious way of finding an adequate remedy. Let us see. In order to agree upon the end in view, let us assume that an eight months' school for every district, irrespective of its number of census children, is the desideratum. It is plain that if we obtain funds sufficient for a district having the minimum number of census children, we shall have sufficient funds for every district. No minimum number of census children has been established by law; let us, therefore, assume fifteen to be the minimum number, although there are quite a number of districts having less than fifteen children, and there is one district which has only *one* child. In the summaries, fronting the report, six hundred and ninety-nine dollars is given as the average amount needed for an eight months' school, for every teacher employed. For large districts, maintaining first grade schools, this average is below the amount needed; but for a district with fifteen children, it is most likely in excess of the amount needed. Let us assume, then, that a teacher is engaged for sixty dollars per month, we need four hundred and eighty dollars for salary; add twenty dollars for fuel, repairs, stationery, and Library Fund deducted from State apportionments, and we have five hundred dollars needed by the district to maintain an eight months' school. * * * In order, then, to give a district having fifteen children five hundred dollars, we must apportion nearly thirty-four dollars per census child, which means that we must raise by county and State taxation nearly five million dollars, exclusive of what may be needed for building purposes. Now, even if the attempt to raise such a sum were not preposterous, the larger districts, that is, those having more than fifteen census children, would be surfeited with funds. A city like Oakland would receive one hundred and two thousand dollars—forty-three thousand four hundred and two dollars more than it expended last year for a ten months' school. We must, therefore, abandon the idea that we can increase the State and County School Funds suffi-

ciently, that, when they are apportioned to the several districts in proportion to the number of census children, each district will receive even only the minimum amount, five hundred dollars, needed for an eight months' school."

I deem it necessary to repeat here my remarks made in eighteen hundred and seventy-three, because, in my opinion, the *amount* of school moneys raised is, primarily, of less importance than the *manner of apportioning* these school moneys; and I hold it to be my duty, therefore, to warn the Legislature against entertaining any proposition looking toward a return to the old system of pro rata apportionments of school moneys. Such a return may be demanded by the larger districts, which lose under the new method of apportioning school moneys; but it can be easily shown that under the pro rata system these very districts would enjoy, in undue proportion, what is paid for by the whole county. Thus Stockton did not have, in eighteen hundred and seventy-three, one third of the assessable property of San Joaquin County; yet it received for the same year, more than one third of all the school moneys belonging to San Joaquin County. It is a fact, that previous to July first, eighteen hundred and seventy-four, the larger districts have, at the expense of the smaller ones, enjoyed greater educational facilities than those to which their assessment roll entitled them; in other words, the smaller districts, whilst themselves enjoying but sorry educational facilities, were taxed to support the schools of the larger districts. Therefore justice, as well as the pressing needs of the smaller districts, demanded a method of apportioning school moneys which would equalize the educational facilities of districts. I recommended such a method to the last Legislature, and this method was, in its most important features, enacted into a law in Senate Bill Number Fifty-six. The following epitome of the bill, with comments, written by me for the *California Teacher*, will show the *modus operandi* by which the new method of apportioning school moneys, first, equalizes the school facilities of the districts, and secondly, gives a sufficiency of funds to each district:

"First—Five hundred dollars has been fixed as the minimum amount of school funds which every district must receive for every teacher assigned it.

"Second—For every one hundred census children, or fraction thereof of not less than fifteen, one teacher must be assigned to a district. In other words, a district having from fifteen to one hundred and fourteen census children, is entitled to one teacher; a district with more than one hundred and fourteen and less than two hundred and fifteen, is entitled to two teachers, etc. For every teacher to which a district is thus found to be entitled, the district must receive five hundred dollars. In order that existing districts with less than fifteen census children be protected, a provision has been inserted in the law whereby a district having ten and less than fifteen census children, will receive three hundred dollars. But no new district can be formed unless there are at least fifteen census children in the proposed new district.

"Third—Provisions are made that the school revenue is at least large enough to give five hundred dollars to each district for every teacher assigned it. But for most, if not all, counties, the school revenue will be large enough to leave a balance after five hundred dollars have been apportioned to each district. This balance must be apportioned, in proportion to the number of census children, among the districts having not less than fifty census children. So that districts having between fifteen and forty-nine census children will receive no more than five hundred dollars, whilst districts having fifty and upwards, will receive more than five hundred dollars.

"From this epitome it will appear: First—That a district must have at least fifteen census children in order to be entitled to the minimum amount of school funds. This number may appear very small, but it was adopted in order not to discriminate too severely against the sparsely settled districts. Secondly—Five hundred dollars is the minimum amount of school fund which every district must receive. This amount will enable a district to keep an eight months' school. After deducting the contingent expenses, and the ten per cent from State School Fund for Library Fund, sufficient funds will remain on hand to enable the district to pay its teacher from fifty to sixty dollars. This salary is certainly low enough. A teacher will have to teach eight months (which will in most cases be all the time for which a teacher will find employment during the year) in order to earn from four hundred to four hundred and eighty dollars; deduct from one hundred and eighty to two hundred and forty dollars for board (a very low estimate), and very little will be left for clothes, books, etc. And yet there is an ex-County Superintendent in this State, and one who has been in office for, we believe, twelve years, who contends that forty dollars a month is sufficient pay for the teachers of small districts. That is to say, a teacher is to earn about three hundred and twenty dollars per annum, pay out of this at least one hundred and eighty dollars for board, and then dress herself out of the remainder as a lady, and buy the necessary books and literature to keep abreast in her profession. Surely our domestics are better paid, for work whose intrinsic merit and cost of fitting oneself for, is as naught compared with the work demanded of teachers And this ex County Superintendent therefore says that 'the idea advanced by some educators to place the minimum amount at five hundred dollars for each district, will prove that the districts containing the least number of children will fare best.'

"We are glad, however, that the Legislature was more liberal-minded, and fixed five hundred dollars as the minimum amount. We hope the next Legislature will raise this minimum to at least six hundred dollars. It certainly needs no argument to prove that the best salary can command the best teacher. If we now give the smaller districts just enough funds so that they can pay teachers just enough to keep them from starving, physically at least, whilst the larger districts receive funds enough to be able to pay salaries somewhat commensurate with the services demanded, we discriminate against the smaller districts as much as ever. For, naturally enough, the best teachers will be found where the best salaries are paid; and the smaller districts will have to be contented with the crumbs and leavings from the educational tables of the larger districts.

"We hold, therefore, that five hundred dollars is the minimum with which a district having the minimum number of census children can be expected to maintain an eight months' school. But, as this amount is too small for the larger districts, we proposed a way of apportioning school funds (see the Fifth Biennial Report, page sixty-three), by which a district with fifteen census children, would have received exactly five hundred dollars, and all districts having more than that number of census children, so much additional per census child. But this plan was

held to be too complicated; and the Legislature determined that all districts having fifteen and less than fifty census children, should receive five hundred dollars, and all districts having fifty or more census children should receive the balance remaining on hand after five hundred dollars have been apportioned to every district for every one hundred children or a fraction thereof of not less than fifteen.

"That even this is a great step in advance, will appear from the fact that of eight hundred and thirty-seven districts having less than fifty census children, seven hundred and eighty-six districts (or over fifty per cent of all the districts in the State) never yet received, and perhaps never would receive, under the old law, five hundred dollars for any one school year.

"Senate Bill Number Fifty six provides that whilst five hundred dollars is apportioned to the smaller districts, the larger districts shall receive as much, and perhaps more, as they have received heretofore. It does this in the following manner: First, the State, by quadrupling its support to the common schools, will nearly, in many counties altogether, in some counties more than supply the means to give the smaller districts the five hundred dollars to be apportioned to them. Nearly all, in some counties all, in a few counties more than all, the County School Fund will therefore go to the larger districts. The minimum amount of the County School Fund will be, in many counties, sufficient to compensate the larger districts for what they may lose on the State apportionment. But should this minimum amount not be sufficient, the larger districts certainly will have influence enough to induce the Board of Supervisors to raise county school funds enough to insure an eight months' school to those districts."

The new method of apportioning school moneys has been in force for just one school year (July first, eighteen hundred and seventy-four, to June thirtieth, eighteen hundred and seventy-five), and we can now judge of its workings from experience. As might have been expected, five hundred dollars has proven not to be sufficient to maintain an eight months' school in most of the districts. There were for the school year ending June thirtieth, eighteen hundred and seventy five, nine hundred and twenty-four districts in the State which did not receive sufficient funds from the State and county. It would be desirable, therefore, to raise the minimum amount which every district must receive to at least six hundred dollars.

In regard to the second feature of the new method of apportionment, viz.: that for every *one hundred census* children or fraction thereof, of not less than fifteen, a definite amount of school moneys must be directly apportioned to each district, opinions differ somewhat. The reasons which induced me to advocate this feature of the law—and which reasons are now as operative as they were two years ago—were set forth in my last report as follows:

"It was shown above, that within certain limits the expenses of maintaining a school a stated length of time are the same, be the district large or small. This will furnish us with the data for devising a method of apportioning school funds by which all districts may have equal school facilities, without the necessity of levying excessive taxes. In other words, if we determine once the limits between which the expenses of maintaining a school are the same, irrespective of the number of census

children in the several districts, we have the data necessary for devising a proper method of apportioning school funds.

"How can we determine these limits? The number of census children belonging to a district do *not* determine the expenditures for school purposes. The average number attending the schools of the district determines the number of teachers needed, and the number of teachers determines the expenditures. A district having from four to five hundred census children may have an average attendance at school of only forty, and need the services of only one teacher; whilst another district, with only half, or less, the number of census children, may have an average attendance at school which necessitates the employment of two, or even three teachers. Such cases are not mere suppositions, but they are *real*. One district of the first kind had thus accumulated several thousand dollars, which were lying idle in the treasury, whilst every other district in the county had to close its school for want of funds.

"But it would be inconvenient to make the average attendance at school the basis of apportioning school funds. It is preferable, for various reasons, to apportion still according to the number of census children, but not in proportion to the number, but taking as basis *the number of census children represented by the average attendance at school*. Except as between counties in apportioning the State School Fund, for as in no county the average attendance, nor even the total number enrolled, equals, much less exceeds, the total number of census children, it would be an injustice against those counties which, as it is, contribute more towards the State School Fund than they receive in apportionments, to lessen their receipts by abandoning the present method of apportioning. This may not seem clear on first thought, but the fact is, no matter how accounted for, that the average attendance is less than the number of census children, in proportion to the density of population and the length of school terms. Such a county as San Francisco would lose nearly five per cent by having the proposed method substituted for the present method, in apportioning the State School Fund between the counties. The proposed method of apportioning must, therefore, be applied only to the districts of a county.

"It is shown in the introductory summaries that the average number of census children belonging to public shools is 50.26 per cent of the total number of census children. If we include, as we should, for we must provide for their education also, the number of children over fifteen years of age who attend public schools, the percentage of the average attendance is only very slightly increased, being even now but 55.36. For every one hundréd census children, then, belonging to a district, only fifty-five children attend school; a number, perhaps, a little large for one teacher, but certainly too small for two teachers. But should a district have over one hundred, up to two hundred census children, the average number belonging would necessitate the employment of at least two teachers. As a *general* rule, it may be safely laid down, that for every additional one hundred census children belonging to a district, an additional teacher must be employed. That this rule will not work in every case will be evident, for in every district the percentage of the average number belonging is not as low as the average percentage of the whole State. And then in the larger cities, the special teachers of music, drawing, penmanship, and phonography, the super-

vising teachers, and teachers of evening schools, added to the number of regular teachers in charge of classes, may change the number of teachers from one to two for one hundred census children. (In San Francisco, one teacher is employed for every sixty-eight census children; in Oakland, one teacher for every fifty-five census children; for the whole State, one teacher for every sixty-five census children.)

"Thus it may be, that for some districts, and especially for the larger incorporated towns and cities having Boards of Education, one teacher must be reckoned for every sixty-eight or less of census children; but if sixty-eight, or even seventy-five, were adopted as the basis upon which to calculate the number of teachers to be reckoned to each district, I have found from an actual and thorough examination of the reports for eighteen hundred and seventy-three, that the number of districts which would receive the number of teachers actually employed by them, would be far overbalanced by the number of districts which would receive an allowance of teachers in excess of the number at present employed by them. And this, as will soon be clear, at the expense of the larger districts.

"The proposed method of apportioning State and county school funds is, then, that for every hundred census children, or fraction thereof, one teacher be allowed to a district, and for every teacher, a certain amount of school funds."

It was only after thorough examination of every other available basis of apportionment, such as according to the average attendance at school, and others, that I found that the only feasible basis was the one advocated in the above extract, and which was finally adopted, with a slight amendment, by both legislative committees on education. As already stated, further study of the question but confirms me in my opinion.

One feature of the new method of apportionment has not worked very satisfactorily, viz: that "all school moneys remaining on hand after apportioning five hundred dollars to each district having fifteen census children or more, for every teacher assigned it, and after apportioning three hundred dollars to districts having less than fifteen census children, must be apportioned to the several districts having not less than fifty census children, in proportion to the number of census children in each district." It has been found that in several counties, the districts with not less than fifty census children have received more than sufficient funds, whilst the districts with less than fifty census children have suffered for want of funds. Several County Superintendents have therefore recommended that the balance remaining on hand should be apportioned pro rata among *all* the districts, irrespective of the number of census children belonging to them. But such a modification of the law would work a serious injury if not an injustice against the larger districts. This was pointedly shown during the last legislative session, when Mr. Crawford, the School Superintendent of San Joaquin County, urged, in a communication to the Stockton *Independent*, the necessity of having all districts, irrespective of their number of census children, participate in the pro rata apportionments. In answer to him, it was shown that, for instance, Stockton would lose, under the proposed new method of apportionment, about six thousand dollars; but that if the clause complained of by Mr. Crawford were stricken out, Stockton would lose nearly two thousand dollars more. And so, in proportion with all the other larger districts. The clause was therefore needed to protect the larger districts against too great a loss.

Still, it cannot be ignored that the clause of the law complained of by Mr. Crawford has favored the larger districts too much. I foresaw this, and proposed, therefore, a plan which would have obviated this objection to the new method of apportionment. My plan (which will be found explained in full in my last report, page fifty-seven *et seq.*) is, briefly, that first, a certain fixed amount be apportioned to each district for every one hundred census children or fraction thereof, of not less than fifteen; and, secondly, that all districts share in the pro rata apportionments of the balance remaining on hand after each district has received its fixed amount. This latter amount is to be—not five hundred dollars—but such that a district with fifteen census children will receive just five hundred dollars from the fixed amount plus the pro rata apportionment. For every census child above fifteen, a district will receive an additional amount. For a full explanation, I must refer to my last report. I there pointed out how the fixed amount to be apportioned to each district is to be found. Assuming that, according to the explanation given on page fifty-eight of my last report, the fixed amount or absolute apportionment to be given to each district is four hundred and seventy dollars for every one hundred census children, or fraction thereof of not less than fifteen, the balance to be apportioned pro rata must be large enough to give a pro rata apportionment of two dollars per census child. A district with fifteen census children will then receive \$470 (absolute apportionment) $+15\times\$2=\$500$; a district with sixteen census children, $\$470+16\times\$2=\$502$; a district with sixty census children, $\$470+60\times\$2=\$590$; a district with one hundred and ten census children, $\$470+110\times\$2=\$690$; a district with one hundred and fifty, $\$940+150\times\$2=\$1,240$; etc.

I present here my method of apportioning school moneys, as advocated two years ago. The provisions seem very intricate, but are very simple in practice. The reason for the seeming intricacies is, that the fixed amount, above spoken of, can only be found by an algebraical formula, and from the expression of this formula in words result the intricacies. I shall show the workings of this method of apportionment by an example:

Sec. 1858. The County Superintendent must apportion all State and county school moneys as follows:

1. He must ascertain the number of teachers each district is entitled to, by calculating one teacher for every one hundred census children or fraction thereof, as shown by the next preceding school census;
2. He must ascertain the total number of teachers for the county by adding together the number of teachers assigned to the several districts;
3. Five hundred dollars shall be the minimum amount to be apportioned to each district for every teacher assigned it, and must be apportioned to each district in the following manner:

(*a.*) He must ascertain the minimum amount of school funds required for the county, by multiplying five hundred dollars in the total number of teachers for the county;

(*b*) If this minimum amount exceeds or equals the total amount of school funds, both State and county, apportioned the next preceding school year, then the amount to be apportioned to each district for every teacher assigned it, must be found by dividing the amount of school funds apportioned the next preceding school year in the total number of teachers for the county, as shown by the next preceding school census;

(*c*.) If the minimum amount of school funds needed for the county, as ascertained in subdivision (*a*), is less than the total amount of school funds apportioned the next preceding school year, then the amount of county school fund to be apportioned to each district for every teacher assigned it must be found as follows:

(1.) Multiply five hundred dollars in the number of census children, as shown by the next preceding school census, and multiply the resulting product in the total number of teachers for the county;

(2.) Multiply the amount of school funds apportioned the next preceding year by fifteen, and the resulting product in the total number of teachers for the county, as shown by the next preceding school census;

(3.) Multiply the total number of teachers for the county by fifteen; subtract the product from the total number of census children, as shown by the next preceding school census;

(4.) Subtract the last product of subdivision (2) from the last product of subdivision (1); divide the remainder by the remainder of subdivision (3); divide the quotient in the total number of teachers for the county, any occurring fraction being taken as one; and the resulting quotient will be the amount in dollars to be apportioned to each district for every teacher assigned it;

4. Any school fund remaining on hand after each district has received, for every teacher assigned it, the amount found due it for every teacher, according to subdivision three of this section, must be apportioned to the several districts in proportion to the number of census children.

The provision (*b*) of subdivision three, reading:

"If this minimum amount exceeds or equals the total amount of school funds, both State and county, apportioned the next preceding school year, then the amount to be apportioned to each district, for every teacher assigned it, must be found by dividing the amount of school funds apportioned the next preceding school year in the total number of teachers for the county, as shown by the next preceding school census," was inserted to provide for cases in which the total amount of State and county school funds, to be apportioned during any school year, were not sufficient to give five hundred dollars to each district for every one hundred census children, or fraction thereof of not less than fifteen.

Let us now exemplify the workings of subdivision (3), from (*c*) on. That is to say:

(*c*.) If the minimum amount of school funds needed for the county, as ascertained in subdivision (*a*), is less than the total amount of school funds apportioned the next preceding school year, then the amount of county school fund to be apportioned to each district for every teacher assigned it must be found as follows:

(1.) Multiply five hundred dollars in the number of census children, as shown by the next preceding school census, and multiply the resulting product in the total number of teachers for the county;

(2.) Multiply the amount of school funds apportioned the next preceding year by fifteen, and the resulting product in the total number of teachers for the county, as shown by the next preceding school census;

(3.) Multiply the total number of teachers for the county by fifteen; subtract the product from the total number of census children, as shown by the next preceding school census;

(4.) Subtract the last product of subdivision (2) from the last product of subdivision (1); divide the remainder by the remainder of subdivision (3); divide the quotient in the total number of teachers for the county, any occurring fraction being taken as one, and the resulting quotient will be the amount in dollars to be apportioned to each district for every teacher assigned it.

According to the census returns for June, eighteen hundred and seventy-four, the minimum amount of school money needed for Yolo County, for the school year beginning July first, eighteen hundred and seventy-four, was twenty-three thousand five hundred dollars; thirty-two thousand one hundred dollars and fifty-three cents was the amount of school money apportioned in Yolo County during the next preceding school year. As the minimum amount needed for the new school year is thus found to be less than the school money apportioned the next preceding school year, the apportionments for the new school year must be made according to the provision last quoted. (Subdivision 3, from (*c*) on.)

The total number of census children is two thousand four hundred and eight, as shown by the next preceding school census returns; the total number of teachers for the county, as ascertained according to subdivisions 1 and 2, is forty-seven. We have therefor for (1) of (*c*) of subdivision three, $500\times2,408\times47=56,588,000$.

For (2) we have $32,100 (the amount of school funds apportioned the next preceding year) $\times15\times47=22,630,500$.

For (3) we have (47×15) subtracted from $2,408=1,703$.

For (4) we have 22,630.500, (2), subtracted from 56,588,000 (1) = 33,957,500, divided by 1,703 (3) =19,939, divided by 47=423+a fraction, which is to be considered as a whole, or 424. This quotient is the fixed amount which is to be apportioned to each district for every one hundred census children, or fraction thereof, of not less than fifteen, that is for every teacher assigned to a district. There are forty-seven teachers assigned, making a total of nineteen thousand nine hundred and twenty-eight dollars, apportioned in fixed amounts. Add to this three hundred dollars for one district having less than fifteen census children, and we have a total of twenty thousand two hundred and twenty-eight dollars, which is to be apportioned to the several districts before a pro rata apportionment can be made. The amount of State and county school fund actually received by Yolo County during the school year ending June thirtieth, eighteen hundred and seventy-five, is thirty-two thousand two hundred and one dollars and seventy-four cents, so that a balance of eleven thousand nine hundred and seventy-three dollars and seventy-four cents is to be apportioned pro rata, agreeable to the provisions of subdivision 4. This gives four dollars and ninety-seven cents for each of the two thousand four hundred and eight census children in Yolo County. A district with fifteen census children will therefore receive $424+15\times4.97=\$498$ 55, or one dollar and forty-five cents less than five hundred dollars, a loss which results from a balance of school money which could not be apportioned. A district with twenty census children will receive five hundred and twenty-three dollars and forty cents; a district with fifty census children, six hundred and seventy-two dollars and fifty cents, etc. The following table will show, in the column headed A, the amount of school money actually apportioned to the district during the last year, and in the column headed B, the amount each district would have received if my method of apportionment had been in force:

Districts.	A.	B.
Prairie	$500 00	$667 53
Gordon	863 30	771 90
Eureka	852 90	761 96
Washington	1,960 15	1,777 45
Grand Island	300 00	300 00
Cache Creek	500 00	578 07
Montgomery	500 00	513 46
Willow Slough	500 00	563 16
Haight	500 00	513 46
Fairview	500 00	642 68
Pleasant Prairie	500 00	597 95
Center	785 00	697 35
Spring Lake	500 00	533 34
Lisbon	764 69	677 47
Grafton	1,788 88	1,603 44
Yolo	1,510 88	1,454 34
Buckeye	759 50	672 50
Fillmore	500 00	592 98
Monitor	500 00	588 01
Clover	500 00	592 98
Mt. Pleasant	500 00	568 13
Sacramento River	500 00	573 10
Woodland Prairie	500 00	538 31
Buchanan	500 00	578 07
Woodland	5,678 04	5,108 52
Vernon	500 00	548 25
Union	759 50	672 50
Putah	500 00	587 07
Canyon	500 00	667 53
Merritt	759 50	672 50
Plainfield	884 06	791 78
Cottonwood	604 15	747 05
Capay	759 50	672 50
Pine Grove	500 00	573 10
North Grafton	500 00	652 62
Monument	500 00	553 22
Liberty	500 00	637 71
Franklin	500 00	523 40
Cacheville	904 82	811 66
Fairfield	500 00	583 04

It remains now to be shown how, if the apportionment had been made according to my method (column B of the above table), the money would have been apportioned more equitably than it actually was apportioned (column A) according to the present law. I have required County Superintendents to report for each district the amount needed to support an eight months school. This, compared with the total receipts of State and County School Funds, will show whether a district has a deficiency or a surplus of funds needed for an eight months school. Thus, the School Superintendent of Yolo County reports that for eighteen hundred and seventy-five Prairie District, which

receives under the present law five hundred dollars, needs two hundred and forty dollars more, in order to support an eight months school. As Prairie District would have received six hundred and sixty-seven dollars and fifty-three cents under my method of apportionment, instead of five hundred dollars, the deficiency of two hundred and forty dollars would have been reduced to seventy-two dollars and forty-seven cents. Gordon District needs seven hundred and twenty dollars for an eight months school, whilst it received eight hundred and sixty-three dollars and thirty cents, or a surplus of one hundred and forty-three dollars and thirty cents. As under my method of apportionment the district would have received seven hundred and seventy-one dollars and ninety cents, instead of eight hundred and sixty-three dollars and thirty cents, this surplus would have been reduced to fifty-one dollars and ninety cents. From these examples it will appear how, under the method of apportionment proposed by me, the funds would have been more nearly equalized than under the present law. The following table will show this for the whole county. In column A is given the deficiency under the present law; in column B, the deficiency under the law proposed by me; in column C, the surplus under the present law; in column D, the surplus under the law proposed by me:

District.	Deficiency.	Deficiency.	Surplus.	Surplus.
	A.	B.	C.	D.
Prairie	$240 00	$72 47		
Gordon			$143 30	$51 90
Eureka			132 92	41 98
Washington			360 15	177 45
Cache Creek	180 00	101 93		
Montgomery	100 00	86 54		
Willow Slough	180 00	116 84		
Fairview	180 00	37 32		
Pleasant Prairie	180 00	82 05		
Center			105 00	17 35
Spring Lake	180 00	146 66		
Lisbon			124 69	37 47
Grafton			188 88	3 44
Buckeye		7 50	79 50	
Fillmore	180 00	87 02		
Monitor	180 00	91 99		
Clover	180 00	87 02		
Mt. Pleasant	60 00			8 13
Sacramento River	180 00	106 90		
Woodland Prairie	20 00			18 31
Buchanan	180 00	101 93		
Woodland	121 96	690 52		
Vernon	100 00	51 75		
Putah	180 00	101 93		
Canyon	140 00			27 53
Merritt		7 50	79 50	
Plainfield			204 06	111 78
Cottonwood	155 85	12 95		
Capay		7 50	79 50	
Pine Grove	180 00	106 90		
North Grafton	180 00	27 38		
Monument	140 00	86 78		
Liberty	180 00	42 29		
Franklin	100 00	76 60		
Cacheville	495 18	588 34		
Fairfield	140 00	56 96		
Yolo	89 12	145 66		

To recapitulate:

First—The old method of apportioning all school moneys according to the number of census children, has been shown to favor the larger districts at the expense of the smaller ones, and to deprive a majority of the latter of nearly all the educational facilities provided by the State.

Second—The method of apportioning school moneys adopted by the last Legislature, places all districts upon somewhat more equal footing. If this method is amended as advocated by me already in my last report, all districts will enjoy nearly equal educational facilities, as far as these can be provided for, in enabling all districts to maintain the same length of school term.

Third—That six hundred dollars, instead of five hundred dollars, will be nearer the minimum amount needed by districts having from fifteen to forty census children.

I therefore recommend that section eighteen hundred and fifty-eight be amended, first, by amending subdivision three, so as to read: "Six hundred dollars shall be apportioned to each district for each teacher assigned it," etc.; and, second, by adopting the method of apportionment suggested above. By these means may we hope to establish a *free* school in every district, and maintain it for at least eight months in the year.

SCHOOL ATTENDANCE.

I am sorry to see that there has been no appreciable abatement in the evils of non attendance and truancy, to which I drew attention in my last report. To show the extent of these two evils, I repeat the table and accompanying remarks given in my last report, making only some necessary corrections to make the remarks applicable to the present time:

The statistics given in the first table are taken from the Census Marshals' reports. The statistics given in the second table are computed as follows: The percentages of the average number belonging are taken from the teachers' reports, and are computed on the total number enrolled in schools, including in this number, of course, all children over seventeen years of age. The same percentages are retained in computing the percentages of the average number of census children belonging to public schools. There may be a greater irregularity of attendance by children over seventeen years of age, especially in country districts, but any errors arising from this source are more than balanced by the number of children over five years of age who do not enter a school until seven years of age, or more. In eighteen hundred and seventy-five, the average number belonging to public schools was 66.17 per cent of the total number enrolled in the schools; 66.17 per cent of one hundred and sixteen thousand eight hundred and ninety-six, the number of census children enrolled in public schools, gives us seventy-seven thousand three hundred and fifty as the average number of census children belonging to public schools, or 46.27 per cent of the total number of census children. In other words, though of one hundred and seventy-one thousand five hundred and sixty-three census children listed by the Census Marshals, one hundred and sixteen thousand eight hundred and ninety-six, or 68.13 per cent were enrolled in public schools, yet only seventy-seven thousand three hundred and fifty, or 46.27 per cent attended school regularly enough to be entitled to be considered as pupils of public schools. The difference between one hundred and sixteen thousand eight hundred and ninety-six and seventy-seven thousand three hundred and fifty, will give us the number of census children which must be classed as truants, that is, children of very irregular attendance; and 21.86, the difference between 68.13 and 46.27, will be the percentage of truancy.

YEAR.	Listed on census......	Enrolled in public schools.....	Percentage enrolled	Enrolled in private schools...	Percentage	Attended no school.........	Percentage .....
1866............	85,152	37,906	44.51	25,475	29.92	21,771	25.57
1867............	94,349	54,726	58.00	18,182	19.38	21,441	22.62
1868............	102,483	60,946	50.64	17,654	17.28	23,583	23.08
1869............	110,642	67,834	61.31	17,344	15.68	25,464	23.01
1870............	121,751	70,030	57.44	24,654	20.33	27,067	22.23
1871............	130,116	83,628	64.27	17,029	13.50	29,459	22.64
1872............	137,351	92,255	67.55	13,787	10.04	30,780	22.41
1873............	141,610	97,681	68.96	12,507	8.84	31,422	22.19
1874............	150,717	105,890	66.29	14,149	8.86	39,678	24.84
1875............	171,563	116,896	68.13	15,021	8.75	39,646	23.11

YEAR.	Listed on census	Average number belonging to public schools	Percentage	Percentage of truancy on number of census children...	Percentage of non-attendance and truancy combined.........
1866............................	85,152	28,232	33.15	11.36	36.93
1867............................	94,349	41,411	43.89	14.11	36.73
1868............................	102,183	45,667	44.69	14.95	38.03
1869............................	110,642	52,168	47.15	14.15	37.17
1870............................	121,751	50,155	41.19	16.25	38.48
1871............................	130,116	65,949	59.68	13.59	36.23
1872............................	137,351	71,481	52.04	15.51	37.92
1873............................	141,610	71,170	50.26	18.71	40.90
1874............................	159,717	70,279	44.00	22.29	47.13
1875............................	171,563	77,350	45.08	21.86	44.97

Two facts are brought prominently to view by the above statistics: the steadily increasing popularity of public schools, and the almost inappreciable abatement of the evils of non-attendance and truancy. In

ten years the attendance at private schools has decreased 21.17 per cent; thirty-six thousand three hundred and twenty children, in a total of one hundred and seventy-one thousand five hundred and sixty-three, have been transferred from private schools to public schools. No greater tribute can be paid to the popularity of our public school system.

But while we are steadily gaining for our public schools the support of those who were at first opposed or indifferent to them, we have signally failed to impress that large class of people who, through self-interest, carelessness, or ignorance, ignore the claims of their children to the rights and benefits of at least a common school education. To have reduced in ten years the non-attendance only 2.46 per cent, or four thousand two hundred and twenty, in a total of one hundred and seventy-one thousand five hundred and sixty-three, and to find that truancy has increased 10.56 per cent, and now amounts to thirty-nine thousand five hundred and forty-six in a total of one hundred and seventy-one thousand five hundred and sixty-three, is a very discouraging showing for our State.

It may be claimed that this is a gloomier showing than the facts warrant. There is little ground for such belief if based upon supposed inaccuracies in taking the census. County Superintendents and Census Marshals were repeatedly instructed to list in the number attending public schools, every child which had attended a public school at any time during the school year, no matter for how short a time, if even only for a day. That this instruction was closely followed, is proved by the number of children which formed the average number belonging to public schools; of one hundred and sixteen thousand eight hundred and ninety-six listed as having attended public schools at any time during the school year, only seventy-seven thousand three hundred and fifty of these have attended long enough and regularly enough to be entitled to be considered as pupils of the public schools. That even among this number a large percentage was irregular in attendance, is proved by the fact that the average daily attendance was only sixty-nine thousand six hundred and fifty-eight, or 40.60 of the total number of census children.

For listing the number in attendance at private schools, the instruction was to exclude all who had at any time during the school year, if only for a day, attended public schools. This instruction was necessary, because the custom had been that if a child had attended both public and private schools, it was so listed. This was especially the case in districts in which private schools were maintained at the close of the public schools; and I have many districts on record in which the attendance at private schools nearly or fully equals the attendance at public schools, and both together far exceed the total number of census children. And this has been the case even in the reports for eighteen hundred and seventy-five, and instead of a shortage there is most likely an excess in the attendance at private schools. For, if in any case the sum of the attendance at public and private schools and the non-attendance, exceeded the total number of census children, the excess was invariably deducted from the non-attendance, making the latter less than the real number. This will seem less doubtful if we bear in mind the natural reluctance of parents to acknowledge that their children are attending no school whatever.

I am aware that compulsion of any kind is repugnant to our ideas of freedom. To force children into school, even for their own good, appears at first sight to be an arbitrary proceeding, and opposed to popular gov-

ernment. And yet education is not only the cheapest defense of the Nation, it is the only foundation upon which our Government can securely rest. I need not point out what fearful inroads ignorance has already made upon our Government. So strongly have we become convinced of the necessity of having every child of our Republic properly educated, that since the most various kinds of indirect compulsion have failed when tried under circumstances which afforded the most favorable condition for the experiment, we have familiarized ourselves already with the idea of compulsory education.

"Compulsory education is un-American;" but so is that ignorance for which it seems to be the only adequate remedy. "It is unadapted to our free institutions;" but ignorance is the destroying angel of those institutions. If our free institutions are to be shared by elements primarily unfitted for such participation, and which refuse to employ the only means by which they can fit themselves to share in those institutions, it is even necessary to compel such elements by means which, though foreign to free institutions, yet are familiar enough to the elements which are to be assimilated. There can be nothing un-American in adapting non-American means to eradicate non-American evils, which refuse to yield to American means. And California need not be ashamed to have taken her stand with Massachusetts, Connecticut, Maryland, Michigan, New Hampshire, New York, and others, in trying to remedy the evils of truancy and non-attendance by "compulsory education."

In this State compulsory education was adopted by the last Legislature, which passed an Act to "enforce the educational rights of children." The Act went into force on the first day of July, eighteen hundred and seventy-four. Even had the provisions of the Act permitted of its enforcement on the date named, the time would have hardly been of sufficient length to test the benefits of the law. As it is, the law could, in fact, not be enforced until the present school year. For the Census Marshals must furnish the list of children subject to the provisions of the Act; but no Census Marshals were in office on or after July first, eighteen hundred and seventy-four—when the Act went into force—until June thirtieth, eighteen hundred and seventy-five; so that the school officers could not be officially furnished with the list of children liable to the provisions of the Act until June thirtieth, eighteen hundred and seventy-five; by which means the possible enforcement of the Act was postponed fully one year after the date named in the Act.

From private information, furnished by County Superintendents and other school officers, I am informed that the law has already exerted a great moral influence. That there is a real need of such a law is proved by the action of quite a number of City Boards of Education in appointing "truant officers," whose sole duty it is to bring or rather force into school such children as are absentees and truants from public schools, against the wishes of the parents. "Compulsory education" has, in a certain measure, been of some years standing; and the Legislature has only enacted into a general law what before was only a municipal ordinance or "rule" of the Board of Education.

I desire to draw the attention of the Legislature to section five of the Act, which certainly needs amendments. Section three must be amended so as to provide that all fines shall be paid to the Clerk of the proper Board of Education, or of the District Trustees, and by said Clerk paid into the School Fund. The way this clause of the section now reads, it might be argued that the fines are paid to the Clerk for his own use and benefit.

To show the mildness of our present compulsory education law, I submit the law at present in force in Connecticut. Connecticut's percentage of truancy and non-attendance is only nine per cent as against 44.97 per cent in California:

"All parents, and those who have the care of children, shall bring them up in some honest and lawful calling or employment; and shall instruct them or cause them to be instructed in reading, writing, English grammar, geography, and arithmetic. And every parent, guardian, or other person having control and charge of any child between the ages of eight and fourteen years, shall cause such child to attend *some public or private day school* at least three months in each year, six weeks at least of which attendance shall be consecutive; *or to be instructed at home* at least three months in each year in the branches of education required to be taught in the public schools, unless the physical or mental condition of the child is such as to render such attendance inexpedient or impracticable."

The penalty for the violation of the above provisions is a fine of five dollars "for every week, not exceeding thirteen weeks in any one year, during which any parent or guardian shall have failed to comply therewith."

The schools of Connecticut are free to all.

No child under fourteen years of age can be *lawfully employed to labor in any business whatever*, unless such child shall have attended some school at least three months in each year of such service.

The penalty for the violation of this law is one hundred dollars for each offense.

THE TEXT-BOOK QUESTION.

This question was brought prominently before the public a few months ago. Unfortunately, it was discussed in only one of its aspects—the economical one; and the discussion of this aspect was again only partial, as it was limited to a discussion of the probable first cost which a change of text-books would entail upon the school patrons of this State. A more comprehensive discussion would have considered the number and bulkiness of the text-books required by our present system of popular education. Strangely enough, this side of the question, and the graver question of the educational value of the whole current text-book system, have thus far escaped general discussion, except when incidentally touched upon by the press and public in inveighing against our "cramming and high pressure system of education." The most prominent educators have been for some time convinced that the gravest, if not all the defects in the internal economy of our present system of popular education are directly traceable to the text-book system of instruction, which more and more prevails in our common schools. The cramming, parrot-drill, multiplicity of studies, and general paucity and inadequacy of results for which our public schools are becoming painfully notorious, are, to a great extent, the products of the text-book as at present constructed and used in school. The success and permanency of our system of popular education depend more

upon the determining of the proper construction and office of the text-book, than upon the successful repelling of the assaults of the most determined opponents of the system. And the necessity of a solution of the text-book question becomes more urgent every day. Already it seems that no instruction is possible in school except through the medium of a text-book. Studies are multiplied and subdivided apparently but to justify or rather to serve as a pretense for the introduction of some more text-books. Again, every change in instruction, whether suggested by universal experience or by the supposed or real success of some individual teacher, is seized upon to justify the making and introduction of new text-books. The results are that teaching degenerates every day more and more into a mere apportioning of the number of paragraphs and pages a pupil must recite; and the ways and means of supplying pupils with the requisite number of text-books have become a very serious question with very many school patrons. It is fortunate that the text-book question is thus brought home to the pocket of parents; for I have hopes that the cost of the present text-book system will lead to that thorough consideration of the whole question which is so urgently demanded, and which otherwise could not have been aroused, for a long time to come, by the urging of solely pedagogical reasons. I seize, therefore, the present occasion of presenting some data from which may be determined the enormous cost of our text-book system; and shall point out where and how a saving has been made and may be made. Of course I do not expect to exhaust the subject; on the contrary, if I succeed only in drawing to it the earnest attention of the friends of popular education so as to lead them to consider thoroughly the merits—if only from the economical standpoint—of the whole question, I shall feel highly satisfied with my labors.

THE COST OF TEXT-BOOKS.

According to the last reports of the School Superintendents, there were enrolled in the public schools of this State, from July first, eighteen hundred and seventy-four, to June thirtieth, eighteen hundred and seventy-five, one hundred and twenty-nine thousand seven hundred and seventy-two pupils, classified as follows:

In high schools or the advanced grade, three thousand two hundred and forty-three pupils; in the first grade, six thousand three hundred and sixty-four pupils; in the second grade, nine thousand eight hundred and thirteen pupils; in the third grade, fourteen thousand and ninety pupils; in the fourth grade, sixteen thousand seven hundred and thirty pupils; in the fifth grade, fifteen thousand eight hundred and sixty-three pupils; in the sixth grade, nineteen thousand one hundred and thirty-three pupils; in the seventh grade, nineteen thousand and four hundred pupils; in the eighth grade, twenty-five thousand one hundred and thirty-six pupils.

According to the course of studies which went into effect the first of January, eighteen hundred and seventy-four, the text-books authorized to be used in the public schools, outside of San Francisco, were:

For the seventh and eight grades, McGuffey's First Reader; for the sixth grade, McGuffey's Second Reader and Robinson's Progressive Primary Arithmetic; for the fifth grade, McGuffey's Third Reader, Robinson's Progressive Primary Arithmetic, and Copy-books Nos. 1 and 2; for the third and fourth grades, McGuffey's Fourth Reader, Robinson's Rudiments of Arithmetic, Colburn's Intellectual Arithmetic, Monteith's

Manual of Geography, and Copy-books Nos. 3 and 4 for the fourth grade, and No. 5 for the third grade; for the first and second grades, McGuffey's Fifth Reader, Robinson's Practical Arithmetic, Colburn's Intellectual Arithmetic, Monteith's Physical and Intermediate Geography, Swinton's Condensed History of the United States, Brown's First Lines of English Grammar, Swinton's Word Analysis, Copy-book No. 7 for the second grade, and for the first grade Cutter's First Book on Anatomy, and Hotze's First Lessons in Physics; for the advanced grade or high schools some eleven or twelve text-books, costing on an average at least one dollar and fifty cents each. In addition to the text-books, just enumerated, Swinton's Word Book, French's First Lessons in Numbers, French and German Readers and Grammars are used in San Francisco; Willson's Spellers in quite a number of schools throughout the State; singing books, drawing books, blank books, etc., more or less in every school in the State. In order, however, to be sure of giving rather the minimum than the maximum annual cost of text-books, let us consider only the cost of the text-books first specified, and reckon them at San Francisco retail prices as given in the catalogues of the book sellers of that city. I credit each child with one copy of every one of the text-books used in the grade to which it belongs. If it be objected that I thereby increase the apparent cost of text-books far beyond the real cost, because in great many cases a child will use the same book in two grades or years, or use the book laid aside by an older brother or sister, it must be borne in mind that this is more than balanced: First, by allowing in the lower grades only one book to each child, when on an average at least two a year are used by such child; second, by calculating the cost at San Francisco retail prices, which, besides being lower than at most stores of the interior, are in some cases given at, say forty-three or ninety-four cents, when of course forty-five and ninety-five cents will be actually collected; third, by allowing nothing for the books used in some parts of the State in addition to those specified under the different grades; fourth, by allowing nothing for the stationery, music books, drawing books, etc., largely purchased by pupils. The following table will, therefore, show a less amount than must be actually paid annually for text-books:

ANNUAL COST OF TEXT-BOOKS USED IN THE PUBLIC SCHOOLS.

For Readers	$62,303 90
For Arithmetics	43,678 78
For Geographies	70,879 00
For Grammars	7,279 65
For Histories	24,265 50
For Word Analysis	6,470 80
For Physiologies	5,091 20
For Natural Philosophies	6,364 00
For Copy-books, about	40,000 00
For books used in high schools, exclusive of Readers	48,645 00
For Slates, about	13,000 00
Total	$327,977 83

—Say three hundred thousand dollars in round numbers.

I shall next show how a little rationalizing of our system of instruction has saved the school patrons about one hundred thousand dollars annually since January first, eighteen hundred and seventy-four, and then I shall consider how much of the above really enormous amount which is at present spent annually for text-books is more than uselessly spent.

In eighteen hundred and seventy the State Board of Education prescribed and enforced the use of a course of studies whose inadaptibility to the wants of our public schools became soon apparent. In eighteen hundred and seventy-three the State Board revised this course of studies, and among other important changes, prohibited the use of some text-books till then used in the public schools, and deferred the introduction of other text-books till the pupil should reach a more suitable age. The changes in text-books were as follows: The use of Willson's Spellers, of Monteith's Introduction to the Manual of Geography, and of Marks' First Lessons in Geometry, was interdicted. Robinson's Rudiments of Arithmetic took in two grades the place of the Practical Arithmetic; the use of a text-book in grammar and in physiology was discontinued in one grade; the use of McGuffey's Sixth Reader and Brown's Institutes of Grammar was discontinued in all grades below the advanced or high school grade. These changes, if faithfully carried out in each school of this State, would save the school patrons annually at least twenty-six thousand four hundred and twenty-five dollars for Spellers; seven thousand dollars for Readers; twenty-one thousand three hundred and fifty-four dollars for Arithmetics; twelve thousand dollars for Geographies; eleven thousand dollars for Grammars; fifteen thousand dollars for Marks' Elements of Geometry; eight thousand dollars for Cutter's Anatomy; or a total of one hundred thousand seven hundred and seventy-nine dollars—say one hundred thousand dollars in round numbers! The pecuniary advantages resulting to the school patrons from the changes made in the course of studies in eighteen hundred and seventy-three are patent; the educational advantages are not less so to those competent and inclined to judge. Only one change—the discontinuing of the use of Spellers—has called forth some animadversion; and an explanation may be needed to prove, not only the advantage, but the necessity of using in our schools no longer the so-called Spellers.

1. Without entering into a long disquisition why the use of Spellers is a most irrational means of teaching spelling, it will be sufficient to state that the profession has for years spent some of its best efforts to devise a method of using Spellers by which the pupil might be so taught that he would leave school able to write orthographically. The most advanced educators have already for some time become convinced that the use of Spellers is against all principles of education and mental philosophy. City after city is following in the steps of California, in requiring spelling to be taught as prescribed in our present course of studies. Horace Mann already showed the absurdity of the use of Spellers when he said: "In Scotland the spelling-book is called the 'spell-book,' and we ought to adopt that appellation here, for, as it is often used with us, it does cast a spell over the faculties of children, which generally they do not break for years, and oftentimes, we believe, never. If any two things on earth should be put together, and kept together, one would suppose that it should be the idea of a thing and the name of a thing. The spelling-book, however, is a most artful and elaborate contrivance by which words are separated from their meanings, so that the words can be transferred into the minds of the pupil without permitting any

glimmer of their meaning to accompany them. A spelling-book is a collection of things without the things signified—of words without sense—a dictionary without definitions. It is a place where words are shut up and impounded so that their signification cannot get at them; yet formerly it was the almost universal practice—and we fear it is now nearly so—to keep children two or three years in the spelling-book, where the mind's eye is averted from the object, qualities, and relation of things, and fastened upon a few words, of themselves wholly uninteresting." All the numerous devices employed to make the Speller anything but a "spell-book" have failed, and must fail. (For the reasons, I refer to page 28* of the Appendix.)

2. A Speller seems to be needed only when the child is required to learn the spelling of *English* words. Require the child to study any foreign language—that is, require it to learn to read, write, and speak, for instance, Latin, German, French, etc.—no Speller is required; and yet the child is introduced into a language of which not only every word is a stranger, but in some cases, as in German, Greek, Russian, etc., the very letters are strange, and of an uncouth appearance. If ever the use of a Speller were a necessity, it surely would be in learning a foreign language. Yet no one has ever yet dreamed of putting a Speller into the hands of the child except when it is required to study its own mother tongue! Can the absurdity of the use of the so-called Speller be made any plainer? It is no answer to say that because English orthography is so erratic that it cannot be learned without the use of Spellers. French orthography is more erratic even than the English, and yet I never have heard of French children being required to study the orthography of their language through the medium of Spellers. How, then, does a child learn to spell the words of a foreign language? Simply by noting how the words are printed or written. If in the case of its own mother tongue the child were required to do the same thing, there would be no need of Spellers, and our children would become better qualified to write orthographically.

3. But the last and strongest argument advanced against the abolition of the Spellers, is that without these text-books our teachers do not teach spelling. That is to say, our teachers, while willing to take up and open the Speller, are not willing to take up and open the Reader, and to note down the words of daily occurrence, and those used in studies, in order to teach the child how to spell. The argument needs no answer. The remedy is evident: the supervising officer, whether Superintendent, Trustee, or parent, need only to examine whether the teacher follows the requirement of the course of studies; and if it is found that spelling is not taught, of course the teacher must be dismissed, and another one engaged who is willing to teach spelling.

But I suspect that the real reason of the opposition to the abolition of the Speller, though called for by every consideration of common sense and philosophy, is that thereby a time-honored institution is abolished. Our forefathers, our fathers, and we ourselves have used the Speller, and our children must use them after us. Still, if with all this constant use of Spellers, our forefathers, our fathers, we ourselves, and our children have failed to become even respectable spellers—and this needs no proof, for it is universally acknowledged—it is, perhaps, time to see if the mode of teaching spelling, recommended by common sense and philosophy, may not succeed where Spellers have failed so lamentably.

TOO MANY TEXT-BOOKS.

It is very generally claimed that our common school curriculum is overcrowded with studies. Now, a study is represented to the parent usually only in the shape of a text-book; and whilst I am not convinced that our curriculum is overcrowded with *studies*, I am fully convinced that our schools are overcrowded with text-books. And no additional study can be introduced, without the Board adopting such study being overwhelmed with offers to supply text-books which are "absolutely necessary to the study." Thus our own State Board of Education has been importuned for the last four years to adopt text-books in "Manners and Morals," "American Ideas," "History of Culture," "History of Literature," etc. Not that many of these books would not be valuable educational auxiliaries if placed in the hands of the teacher; but as *text-books* in the hands of pupils they would but extend the sphere of that purely mechanical memorizing of lessons, which is at present so prevalent in our schools.

It being understood that by text-books are meant books which are to be used by the pupils, it can be easily shown that if language—spelling, word analysis, grammar, and composition—were taught without text-books, more satisfactory results would be obtained in this study than under our present system of teaching it by means of text-books. The English language has been well called the "grammarless tongue." "The two elements of grammar," says R. G. White, "being etymology, which concerns the inflections of words, that is, changes in the form to express modification of meaning; and syntax, which concerns the construction of sentences according to the formal relations of words; and the English language being almost without the former, and, therefore, equally without the latter, its use must be, in a corresponding degree, untrammeled by the rules of grammar and subject only to the laws of reason, which we call logic." * * * We have, in speaking or writing English, only to choose the right words and put them into the right places, respecting no laws but those of reason, conforming to no order but that of logic. It is very plain, therefore, that if every exercise of the school-room, in which words are either spoken or written, is made an exercise in the use of language, better results will be obtained than by means of a technical, *i. e.*, text-book, study of language, the usual result of the latter being a skill in the enunciation of rules, and an utter ignoring of these very rules in speaking and writing.

The German system of teaching language is the most striking proof of the ease with which language can be taught without the use of text-books. The German language is perhaps one of the most complicated of modern languages, and it is nearly as far removed from the grammatical simplicity of the English language as the Greek language is. A German writer must, therefore, be a grammarian in the ancient sense of the word; "but some of the best English that has been written is the simple, strong utterance of ignorant men, entirely undisciplined in the use of language." If the German method of teaching language produces good German writers—and such is undoubtedly the case—why should not the same system of teaching applied to the English language, produce good English writers? Professor William H. Young describes the German method of teaching language, in these words:

"German language includes reading, spelling, writing, grammar, recitation or declamation, and composition, and consumes six to eight hours, weekly, of the 'simple instruction time' and eight to ten hours of the 'extended time.' Instruction in the several particulars is, for the most part, simultaneous—the aim being to give the child readiness and exactness in the various uses of language, written and spoken, with a constant effort to make each exercise help the other.

"The end of each year's work is laid down as follows:

"*First year*—Oral resolution of short sentences into words, of words into syllables, of syllables into sounds with distinction of vowels and consonants; writing by syllables, of words of one, two, and three syllables, and reading of the writing; knowledge of printed text; reading of words, sentences, and easy paragraphs, and beginning to copy printed into written text.

"*Second year*—Reading of connected paragraphs with regard to intonation and meaning; syllabic and phonetic spelling; copying from Reader to slate with and without syllable separation; rewriting from dictation what has been already written from reading-book, with special reference to the written marks of emphasis, accent, and inflection.

"*Third year*—Reading print with special reference to exactness, fluency, and expression; understanding of what is read by explanation of unfamiliar terms, word relations, and construction; the simple sentence (subject and predicate), article, noun, adjective, verb; formation of plurals of nouns; past, present, and future tenses, indicative active; written exercises in sentences with above-named elements; copying from reading-book with separation into syllables; writing from memory paragraphs learned from reading-book; writing from dictation what was formerly copied from Reader; rapid spelling with simple rules of orthography; beginning to write on paper, large and small letters and words, between (rather wide apart) lines.

"*Fourth year*—Reading exercises of last year combined and reading of Roman print begun; simple sentences extended by objects; declension of nouns; nominative case, singular and plural, of personal pronouns; all tenses of indicative, simple form of infinitive, imperative; changing of active into passive form sentences; grammatical and orthographical written exercises; short compositions, ornamental writing within lines, and beginning of Roman script.

"*Fifth year*—Correct and fluent reading of German Roman print and brief recital of what is read; simple sentences extended by adverbs of place, time, quality, and manner; prepositions, and their relations; declensions of nouns with adjectives; comparison of adjectives; numerals, possessive, demonstrative, and interrogative pronouns; dictation writing, composition, and ornamental penmanship within (closer) lines.

"*Sixth year*—To reading is added more detailed recital of what is read; reading of various handwritings; compounding of sentences, uses of conjunctions, conjugation of active and passive forms; writing from rapid dictation; composition in narrative and 'story' form as before, with introduction to delineation and letter-writing; ornamental writing in German script on a single line.

"*Seventh year*—Higher expression in reading and orderly or well composed recital of what is read; reading of various handwritings; compound structure of sentences, subjunctive mode and relative pronouns; higher composition, reproduced in extended and abridged form, with manifold sentence manipulations; letters and business compositions; higher penmanship.

"*Eighth year*—Reading, composition, writing from dictation, and penmanship, as in seventh year; analysis of sentences; word roots, derivatives, and classification of words by families.

"The most striking features of all this are: (1) The 'Reader' is the basis of it all—only slate and paper besides being used—no 'Speller,' no 'Composer,' no 'Grammar'—only a few grammatical tables appended to the Reader. (2) The vast amount of writing involved: from writing-lessons, from spelling-lessons, from Reader, dictation, memory, composition, etc. The result is, Germans write well and as readily as they talk. (3) The manifest practicalness of every step. There seems to be nothing done in the school-room that the people are not daily doing outside."

If we turn now to the study of arithmetic it will be seen that a text-book is provided for the very first school year, and hence for children who are not able to read the greater part if any of the text of the book. But why should children be required to purchase and use a book which they cannot read? The illustrations alone cannot justify the introduction of the book; for these can be more profitably replaced by actual objects. Experience has at last proved that for the first four years of school life arithmetic can be most profitably and philosophically taught without text-books; and the so-called Primary Arithmetics are retained in great many cases only in deference to the wishes of parents and children, who cannot understand how a study can be pursued without a text-book.

Again, what is the use of a separate text book in "Intellectual Arithmetic?" Could the examples given in the book not as well be formed by the teacher? Or if the teacher could not do so—for want of time or skill—would it not be sufficient and more to the purpose to place the book simply in the hands of the teacher? Or if the lessons must be conned by our pupils—whereby, of course, the real object of the book is destroyed—why not incorporate them into the books on written arithmetic, and then force pupils and teachers to let *written* arithmetic, that is, the solving of examples which are too long or complicated for rapid mental solution, always be introduced by examples which can be readily solved mentally? What a satire on our method of teaching it is to require our pupils to learn *written* arithmetic through one kind of text-book, and *mental* arithmetic through another kind of text-book! Again, look at our so-called series of Arithmetics; four and five books, where two would be sufficient.

Then let us examine our text-books on geography. Three or four books in each series, and each book but repeats, with a few additions, what the next lower book already taught. Monteith's *Manual of Geography* differs from the *Introduction to the Manual* only in that it has a few additional map questions and a little historical information which the other wants. Both books can be used side by side; yet two years ago, our children were required to wade first through the *Introductory*, then through the *Manual*, and then through the same trash again in the *Intermediate and Physical*. One text-book on geography would answer all the wants of our common schools.

The Kindergarten will teach us how the "elements of form" can be taught easily to children younger than our youngest common school pupils without the use of a text-book. Agassiz, thus far the greatest *teacher* of the natural sciences, could not emphasize enough, and reiterate often enough, the great truth that Nature is the text book to be studied in order to learn the elements of any science, and instead of

text books, place muslin nets and botanical portfolios in the hands of the children, and set them to scouring the country, "catching butterflies, bottling insects, and gathering flowers." Studying the phenomena of Nature as indicated in the article on geography, given in the Appendix (page 61*), will teach pupils more of natural philosophy than can be taught by their thumbing the most voluminous text-books.

Miss Youman's *First Book of Botany* is perhaps the best elementary text-book ever published in the department of natural history. But the use of even this text-book is uncalled for, and radically opposed to the theory and practice of the teacher—Professor Henslow—according to whose method of teaching the book is constructed. Instead of pupils being required to learn the parts of plants by comparing them with the pictures of the books, they should learn them by comparing them with actual leaves, for their color, structure, size, and surface, as seen in nature, cannot easily be represented in pictures. And if comparison with pictures is necessary, botanical charts are far preferable to the pictures of the book. And the *schedule*, according to which the parts must be described, can be easily placed on the blackboard by the teacher. Therefore, while I believe that Miss Youman's book will furnish the teacher with the best method of teaching the elements of botany, the book itself should not be used by pupils as a text-book. Of course, the publishers claim that "plant and book should go together," but the experience of our most eminent naturalist teachers—as Agassiz in Zoölogy, De Candolle, and Professor Henslow in Botany—teaches just the reverse; and one of the objects in the establishment of the Penikese School of Natural History was to teach teachers how to instruct according to the Book of Nature, and not according to some text-book. "Children must be taught to open their eyes and look upon Nature for themselves, and make Nature, as it surrounds them, its own text book." "Whenever we study books," says Agassiz, "we are one remove away from the things we study." "Reading is seeing by proxy," says Herbert Spencer; "is learning indirectly through another man's faculties instead of directly through one's own faculties."

OUR TEXT-BOOKS ARE TOO BULKY.

"The faith in lesson-books and readings," says Herbert Spencer, "is one of the superstitions of the age." This is shown not only by the multiplicity of text-books by which our system of education has been changed into a system for "the production of artificial stupidity," but also by the bulkiness of our text-books. Most of our text-books are lumbered with a great mass of useless details, which in some cases completely smother, if not exclude, what alone is of real importance to the pupil. Why must every book in a series of arithmetic, open with definitions of *arithmetic*, *number*, *quantity*, etc.? It is undoubtedly the *teacher's* duty to show the pupil the way for working an example; yet why must a text-book, which is to be used by the pupil, be lumbered with explanations, illustrations, rules, etc., which, to be of any use at all, must be adapted to the comprehension of the pupil, in which case the teacher's office is reduced to that of a mere overseer, whose duty it is to see that the tasks are faithfully performed. How can pupils be taught dependence upon themselves—the first factor in every education deserving of the name—with our present series of Arithmetics? Again, look at the so-called map questions of our Geographies; why cannot our

pupils be taught to exhaust the contents of a map according to a single scheme or schedule?

The first two pages of a *Language Primer*, recently published, read as follows:

I.—OBJECTS AND WORDS.

☞ Teacher, holding up *a book*, *a pencil*, *an orange*, etc.:
What is this? A book.
This? A pencil.
This? An orange.
This? A bell.

1. What are all these?
They are all things, or *objects*.

2. How do we learn about such things, or objects?
We learn about them through the senses.

☞ Now I shall name two other things, or objects: *Love, gladness.* We do not know these things through the senses.

3. How do we know these things?
By *thinking about* them.

4. What is an object?
An object is anything that we can learn about through the senses or that we can think about.

5. When I say *book*, is that an object?
No; it is a *word*, or the *name* of an object.

☞ Teacher, writing on the blackboard the word *book:*

6. Is that an object?
No; it is a word, because it is the name of the object *book.*

EXERCISE I.

☞ Teacher, holding up in succession various objects:

1. What is the name of this object? Of this? Of this?
2. Write on your slates the words that are the names of these various objects.
3. Write the names of ten different objects you can see, or think of.

II.—OBJECTS AND WORDS.

☞ We may write in a list the names of objects that we can see in any one place, as in *a school*, *a church*, *a parlor*, *a railroad car.*

EXAMPLE: A School.

Seats.	A map.	The globe.
Desks.	A stove.	The bell.
Tables.	A clock.	The piano.

☞ We may write in a list the names of the various parts of different objects, as *of a book, of a flower, of a knife, of a gun.*

EXAMPLE: The Parts of a Book.

The cover of a book.
The leaves of a book.
The back of a book.
The title of a book.

EXERCISE 2.

a. Write the names of objects you can see:

1. In a church.	3. In a railroad car.
2. In a parlor.	4. In a grocery store.

b. Write as in the example the names of the different parts of these objects:

1. A flower.	3. A gun.	5. A dress.
2. A knife.	4. A barrel.	6. A coat.

Now there is need of illustrating in this manner a *manual written for teachers*, but what use is such matter in a text-book to be used by children, except to increase the bulk of the book, and thereby its cost to parents? I could easily show that many of our present text-books are filled with just such matter, which, while in place in manuals for teachers, are worse than useless in text-books.

Our text-books are not only too numerous; they are also too bulky; but no reform can be expected in this matter until insisted upon by parents, who have to foot the bills for text-books; and what interest the parents have for seeking this reform, was illustrated above, when I showed how a hundred thousand-dollars are annually saved by the dropping of three or four text-books.

THE REMEDY.

I say that the reform can come only at the instance of the parents, for teachers are powerless so long as parents insist upon making the text-books the standard by which to judge of the teacher's labors. It is a sad fact, and illustrating the popular "faith in lesson-books," that many parents do not consider that a child is pursuing a study unless it uses a text-book in that study; and a child's learning—for it cannot be called education—is measured by the child's ability to repeat, *verbatim et literatim*, the text of the book. A child may have been taught "a *way*, not a *rule*, for working an example," by which it can make a rule for all similar examples, yet unless the child can perform an example in accordance with the explanation and the rule given in the book, "all is wrong." Attend any public examination of scholars, and note how the committee fasten their eyes upon the page to ascertain whether the pupils answer correctly. Unable to distinguish between the chaff and the wheat, they measure a teacher's success by his ability of "cramming the indigestible mixture [of many of our text-books] down the child's throat." Is it not a necessary sequence, then, that "all the faculties of the mind, except memory, become discouraged, disheartened, benumbed, and fall asleep, while memory is goaded, and lashed, and chastised, and spurred on, driven at a break-neck, hap-hazard pace, 'by the whips and scorpions' of senseless teachers, until at last the child becomes an intellectual dwarf, or a walking cyclopedia, going up and down the earth with indefinite aims and unfruitful ends?" Is it to be wondered at that "the teachers become lost in the text-books," and that "there is much twaddle published, but more twaddle elected to teach it?"

But in addition to a close scrutiny of the number and size of the books to be used in our schools, a determined stand must be taken against the introduction of text-books similar to the *Language Primer* mentioned above. For whence come such books, and what is their use?

"Certain teachers, practical and successful themselves, have sought to make others so by publishing text-books, containing their plans, methods, illustrations; text-books, in fact, furnishing the precise language which teachers should use in the school-room. Such authors have unwisely supposed that because success followed these methods in their school, that they were to revolutionize entirely the instruction in this department by throwing their methods and their exact language into the form of a text-book. But how insipid such books are in the hands of pupils, and how utterly impossible it is for one teacher to use the precise methods, the same anecdotes, the identical language of another in the school-room! These methods may be almost perfect, so far as the author is concerned, but when used by him they were original; they came from his brain, his mouth, his eyes, his face, not from a book; and when they are transcribed upon the cold page of a text-book for others to use, and especially for pupils, they prove to be purgatives rather than tonics. There is a number of such books now surfeiting the market, and which are unfortunately being introduced into our schools; books which read well, and which are excellent for young and inexperienced teachers to consult as reference books, as reservoirs from which to take drafts before going into the school-room, but which are absolutely injurious and out of place in the hands of pupils. They are not, or should not be, intended for pupils, but only for those teachers who must have some substitute for their own mental deficiencies. What is the meaning of all these new departures? It is, to my mind, a fruitless and unphilosophical attempt to make text-books that shall stand in the place of the teacher. It is an unwise and unholy plan to bolster up poor, inexperienced, and unskilled teachers. Instead of going down to the foundation of things where the radical defect lies, and saying to every teacher, '*Unless you feel competent to teach this school, so far as mere instruction is concerned, without the aid of a single text-book, you cannot have the school,*' we are trying to make text-books which shall at the same time serve the double purpose of furnishing instruction to both teacher and pupil. As well may we attempt to make 'a fountain send forth at the same time sweet water and bitter.' 'Can the fig tree, my brethren, bear olive berries? either a vine, figs? So can no fountain both yield salt water and fresh.' What is intellectual food for the young pupil is not the nourishment which teachers need."—[*A. F. Nightingale.*

The text-book is the bane of American schools. As Agassiz says: "Pupils are made too much to turn their attention to books, and the teacher is left a simple machine of study." "The text-book now holds sway in the school-room; it sits enthroned, a despotic tyrant over both pupil and teacher. Teachers are the slaves instead of the masters of these

working tools, designed for the exclusive use of pupils." The teacher has been reduced to a mere machine for measuring off the lesson the pupil is required to learn each day. Hence, as a natural consequence, the popular low estimate of the functions of a teacher; the too frequent substitution of the undeveloped, undisciplined, and unskilled "school-keeper" in place of the practical, skilled teacher; and the power of "politics, poverty, and piety," in the certificating and appointing of teachers. It is only by reforming our present text-book system that we can hope to remedy many of the abuses which, unfortunately, can now be justly charged against our school system. And if parents only became convinced that the immense outlay for text-books now so cheerfully borne by them, can be materially reduced, not only without injuring the cause of education, but to its positive benefit, we shall soon see the dawn of better days.

ANOTHER REFORM DEMANDED.

There is not only a need of a reduction in the number and size of our text-books, but a reform is demanded also in the manner of supplying and designating text-books. Publishers of school-books seem to be anxious only to provide as many books as they can force into the schools; and, in addition, a rage has seized them of providing wares that "will sell in a cheap market." The text-book interests have reached colossal dimensions; and the power placed in the hands of our State Board of Education is now so great, that its exercise, no matter if determined exclusively by a consideration of the real needs of the schools, must always give rise to sinister imputations. It is notorious that "publishers send out an army of agents, panoplied in armor, both *defensive and offensive, which reaches from the brain to the pocket;* agents who are wise as serpents, and harmless as—lions, going up and down the country seeking whom they may devour." And the natural result is that after a Board has adopted, or readopted a series of text-books, no matter if they acted with perfect integrity, unbiased by any outside influence, their good intention, wisdom, and integrity, are assailed. Witness the last text-book conflict in this State. And witness the text-books prescribed under our present system. McGuffey's Readers in place of Willson's, and a probability of having another deterioration in Readers, by the possible adoption of the Pacific Coast Series. Can worse Geographies be found in the market than Monteith's? Book agents must certainly have found enough in this State "to devour." Our schools are now practically at the mercy of publishers.

I am convinced that the interests of education suffer under the present system of supplying and prescribing text-books for the State: First—Too many and too bulky books are prescribed. Second—Some of the poorest instead of the best text-books have been forced upon our schools. Third—Elements of corruption are thereby introduced into our system. And fourth—The taxes for text-books have been made unnecessarily onerous to the school patrons. These evils will not be remedied by a mere abolition of the "State uniformity;" on the contrary, without such uniformity the evils would be increased by the addition of that confusion in text-books which is a prominent evil other States have to deal with.

What we need is, that in place of a list of prescribed text-books, too numerous and voluminous by half, the contents of which the teacher is expected to teach his pupils the best way he can, the State Board of

Education first prepare a clear and precise statement of the aims and requirements in regard to each subject of instruction; then, secondly, a clear and precise statement of the best methods of handling a subject rationally and economically. In short, the Board, and through it, the State, must furnish each teacher with a *Manual of Instruction.* By this means we can dispense with several text-books, and reduce the bulk of the remaining text-books by rigidly excluding therefrom every thing which appertains exclusively to the teacher's office. A text-book should be, what its name implies, a "*book of texts.*" "The sermons are to be preached by the teacher—the book is to furnish the texts which are to be analyzed, developed, unfolded, explained, enlarged upon by the teacher—texts which need an exegesis to make them understood."

The Manual of Instruction will furthermore point out to teachers the course of culture and technical training needed by them to qualify themselves for their work; in other words, it will prepare teachers for their work. Being no longer able to rely upon the text-book, teachers will be compelled to assimilate some method of teaching, and, in time, will then become real teachers, instead of mere school keepers.

I also invite attention to the plan of "free text-books" which has already met with considerable favor. I feel confident that its adoption, if practicable, will materially reduce the cost of text-books. I quote the description and workings of the plan from the Report of the State Superintendent of Wisconsin, Honorable Edward Searing:

"Free text-books offer several substantial advantages which mere uniformity cannot secure. In the first place, they are strictly consistent with—nay, the logical result from—our theory of free schools. We hold general education to be the safeguard of our republican institutions. We hold that the State can secure a closer approximation to universal education than can be secured by denominational and individual effort. Hence the State system dots our plains, hills, and valleys, with school houses, putting one almost within sight of every man's door. It furnishes free seats therein, free maps, charts, globes, blackboards, and, to crown all, free instructors. The State says to all her children of school age: 'Come, use, and enjoy these means of instruction, without money and without price.'

"Such is the beautiful and alluring theory. But are facts really in harmony therewith? Is this proffered instruction so free that the seven children of the poor man can partake of it as easily as the two or three children of the rich man? The seats in the school houses may be free, but is suitable clothing for the seven so easily obtained that every term they may occupy those seats with a feeling of self-respect? The maps, blackboards, and dictionary may be free, but are the more indispensable Readers, Arithmetics, Spellers, Geographies, etc., as free for the unfortunate seven? The services of the teacher may be free, but is the leisure of the seven so free from the necessity of productive labor that they can for any length of time continuously receive the benefit of those services?

"Let him who is wont to boast of our 'free' school system, to become indignant over the statistics of non-attendance, and to call loudly for a compulsory law to drive into schools the children of the 'indifferent'—let him conscientiously and thoroughly investigate the true causes of non attendance, and he would probably exhibit an accession to his

previous stock in the virtues of wisdom, benevolence, and reticence. In this investigation let him justly estimate the cost, to the poor man above mentioned, of the additional clothing necessary for the barely respectable appearance of his children in school, the cost in their cessation from productive labor in order to secure the advantages of a sufficiently continuous and protracted connection with the school for the acquirement of even a little less than a fair common school education, and the cost of the necessary text-books—a constantly recurring and no inconsiderable money tax, as every patron of the school knows—let him, I repeat, investigate these three sources of expense in school attendance, and no longer wholly ascribe to absolute 'indifference' a degree of illiteracy due to causes less disgraceful to our common human nature. I believe that very few parents are so absolutely indifferent to the welfare of their children as not to care at all for their intellectual culture—to the extent at least of their ability to read and write. Illiteracy is confined almost exclusively to the extremely poor, and is the result of poverty, rather than of such want of natural affection for their children as would lead parents wholly to disregard their best interests, in not securing for them any degree of intellectual culture whatever.

"If this be true, then the State, before seeking compulsory attendance, should seek to remove as many as possible of the barriers that separate poverty from culture. The abolition of the rate-bill was the removal of one. Evening schools are, in many cities and villages, a partial removal of another. Free text-books in all free public schools would be the entire removal of still another. With this last barrier of expense, immediately and necessarily attendant upon education, removed, our system would indeed be free. No longer would it involve, under this term, the paradox of an unavoidable annual cost of books to the individual pupil several times the amount given by the State to secure merely free instruction.

"Not only would the text-books in the schools, by making the latter truly free, largely remove the exense for and cause of non-attendance and illiteracy, but they would bring many other positive and manifest advantages. Rather, however, than to set them forth in detail myself, I prefer to quote from what has been published on the subject in other States. By thus doing, I shall present not only the arguments of reason, but the more satisfactory illustrations and proofs of actual experience with the working of the system of free text-books elsewhere. I urge a careful consideration of the following, taken from the last annual report of Hon. Warren Johnson, Superintendent of Public Instruction of the State of Maine:

"'At first thought it would seem sufficient provisions have been made for the education of *all* our youth, when the school house and the teacher, shelter, and tuition, had been freely granted at public expense. The pupil, however, can accomplish but little without books—his tools. To furnish these at private expense, proves in many instances a hardship, particularly to poor parents with large families, and more especially to the itinerant laboring class. To lighten this burden, some States have established regulations by which the same series or editions of text-books should be used throughout the limits of the State. This plan has not invariably been successful. Within a few years it has occurred to some of our most intelligent communities that the burden can be entirely lifted from the classes indicated by furnishing books at public expense, precisely as school shelter and tuition are. The advan-

tages of this plan were alluded to in my last report, and the experience of the City of Bath was brought in testimony, as presented in the report of Superintendent S. F. Dike. I am pleased to call the attention of school officers to this important feature again this year, by presenting the following communication from Thomas Tash, Esq., Superintendent of Schools, City of Lewiston. The plan is equally desirable and possible in *all* our towns, and, it seems to me, would be readily adopted by our people, if school officers would clearly present the same for their consideration at the annual town meetings. By reference to Section Six, School Laws, it will appear that sufficient authority is given towns to accomplish this desirable object, broadening present school facilities with immense advantage to children and large saving of expense to parents.'

"LEWISTON, November 20th, 1873.

"HON. WARREN JOHNSON:

"DEAR SIR: In answer to your inquiry, I beg leave to present the following as some of the advantages which have resulted from the adoption of the 'free text-book' plan in this city:

"1. *Books are ready at the proper time.*—When parents furnish books much time is often lost to scholars, and much inconvenience felt by teachers, especially at the beginning of the year, by delays in procuring proper books. Parents are also subjected to much inconvenience and vexation by being so often called upon to procure books and other materials for school use. Those having large families of children find their slender incomes taxed to the utmost to procure these supplies, while those in affluence assure us that the supply of free text-books relieves them from a frequent and troublesome annoyance. Our wealthiest men are among the best pleased with the results of this experiment, the expense is so insignificant compared with the time, trouble, and criticism which it saves.

"2. *Every child is supplied with all the books, etc., needed.*—No odious distinctions are now made. Our schools are, as they never were before, absolutely 'free schools.' The city label in a book is no longer a mark of pauperism, but a mark of sovereignty, and attaches to all alike. It is as honorable for a child to bear home a school book having the city mark in it, as the book bearing the label of a free city library. There is no longer *fussing* to get the books furnished to indigent pupils into their father's tax bills. This is a convenience to our city authorities.

"3. *Uniformity in books.*—Non-uniformity has been a source of as much vexation in the schools as in the church, and it has been vastly more pernicious. In rural schools there has always been encountered the inconvenience of a multiplicity of unlike text-books. Many extra classes have had to be formed in consequence, as is now the case in most rural communities. Where free text-books are furnished, this difficulty is obviated. Again, there is no longer complaint from those moving from city to city, that books are different. They are at no extra expense in consequence.

"4. *Considerable latitude can be allowed in the selection of books, without increasing the expense of them.*—Wherever there are several schools in different parts of a city or town, of the same grade, as Grammar or Intermediate Schools in the same city, teachers may be allowed a choice in the books they are to use. The school book is a tool, and the workman will work all the better with a tool of his choice. It is unpleasant

to hear a teacher affect to have no choice in the text-books to be used. I would as soon hear the woodman claim to have no choice in his axe! A perfect workman will use to advantage even a poor tool, I am aware, but he will use, with much more pleasure and success, a good one. If the teachers of such parallel schools are held with their classes to perform topically the same amount of work in a given time, and the School Board sanction several series of geography or arithmetic, for example, as is now done in the City of New York, in which the work may be done, giving the choice of tools, but holding responsible for the work, no inconvenience could arise, but manifest advantage. One series of books is about as expensive as another, and the city might not be unwilling to divide its patronage, satisfy its teachers, and test the various books, all of which can be done under the plan of free text-books, with no additional expense to itself, but with the positive saving of securing to itself from all publishers the best possible terms. Again, in the successive classes in the same Grammar School, different books adapted to the progress of pupils, as United States History, for instance, might be used on the same subject, with no additional expense to the city, as each class must have its own book, whereas, while pupils find their own books, it would be found a necessary saving of expense to them, to keep children during their entire course in the same book, even at considerable positive loss.

"Whenever a change in a text-book is desired, as it sometimes is, it may be made when new books are needed, changing in one class of the grade at the time, until the old books are used up. This would be affected without loss, and it would *discourage*, on account of the time required, inconsiderate changes. A book could, before its general adoption, be tested in a single room or class, and, if found unsuitable, rejected without much, if any, loss.

"Necessary changes could be made in the different schools of a country town, by transferring the books no longer used in one district to another, without much expense or inconvenience. In this way the best and most modern books can be brought into use, as new books are needed, as well there as in the city, and without additional expense, if the town is the owner of the books used.

"5. *Books are more entirely under the control of the teacher.*—This is of considerable advantage in enabling the teacher to fix more definitely the hours of study. Over study is often more pernicious than lack of study, and is less easily controlled by the teacher. The former destroys the best scholars, the latter only injures the poorer. If books may be taken home or not, at the discretion of the teacher, the time devoted to study may be largely determined, and the teacher is fairly responsible for it.

"6. *Books furnished by the town or city are much more carefully used, and better kept than when owned by the children.*—It might at first be supposed that this would not be so, but uniformly it is found to be true; there being four parties interested in the preservation of these books—school officers, teachers, parents, and children. Small books used in the lower grades by young children must be expected to wear out, and to need replacing, annually, perhaps, but their cost is trifling—the larger and more valuable books in the higher classes will be used in successive classes many years.

"Where books are owned by children, the writings and drawings in many of them are most vicious, but in books owned by the city nothing of the kind is allowed, so that it becomes a measure conducive to good morals among the young. The proper use and the careful preservation

of their books is a most valuable lesson to scholars, and of itself goes far to justify the policy of furnishing free text-books.

"7. *It leads parents to procure reference books, useful both to themselves and their children.*—When relieved from the constantly recurring expense of procuring school books, parents are found much more ready to procure other books on the same and collateral topics—books more general in their scope. Teachers and school officers may do much to encourage this, thus making the public schools in the broadest sense a home educator.

"8. *Convenience in making transfers.*—In graded schools, and in mixed schools, also, the greatest impediment to transfers in making proper classification, is the want of suitable books. When books belong to the city or town, the advancing of pupils to higher grades or reducing them to lower is comparatively easy, and much less often the subject of home criticism. When scholars are promoted *on trial*, the books belonging to themselves last used immediately disappear, and the lack of them furnishes a stronger argument for maintaining their place, oftentimes, than ability or diligence. Where books are free this inconvenience vanishes.

"9. *The free supply of books increases school time.*—It increases both the number of pupils entering school, and the length of time on the average that they remain there. From careful observation, where the plan of furnishing free text-books has been adopted, it is found to increase the number entering school, it is believed, from five to ten per cent. Time is further saved by children entering school more promptly, not having to wait for books, in all grades and kinds of schools; at the same time they will remain longer in the higher grades, the premature withdrawal from school among the higher classes having been largely caused by inability to meet conveniently the expense of the costlier text-books. How much time will be saved in all these directions, and in the prompt beginning of their study and recitations at the beginning of the terms, cannot be estimated, but certainly a very large portion in every town. On this saving, we may, in the presence of those who value general education, safely rest the argument in favor of free text-books.

"I cannot do better in closing, than to quote a short extract from the last report of the School Board in Lewiston, from the pen of our Governor-elect, written some months after the plan of furnishing text-books free for their schools went into operation in that city, the more fully justified the longer the plan has been continued:

"'Under this plan, the first cost of text-books for the pupils in our public schools will not be over one half of what it has been under the old plan of requiring pupils to purchase for themselves. Again, as scholars leave their books with the Superintendent when they have completed them, the same books will be made to do service two or three or even more times, while under the old system they have too often been thrown aside after being used by one scholar. It is believed that the expense of school books under the new plan will not exceed one half what it was under the old system. This, indeed, has proved to be the case in Bath and some other cities that have inaugurated the free text-book system. Besides, the experience of these cities has demonstrated that the books are better cared for under a system in which the pupil receives them as a loan, under the supervision of the teacher, than that in which the pupil has the ownership, and regards himself as having a right to do as he pleases with his own. Besides, the difficulty often hitherto experienced in inducing parents to supply their children with

school books, and the frequent loss of time to the pupil from a want of such books, are entirely avoided under this system. And more important than all other considerations, many children who have been kept from school simply because their parents could not, or would not, incur the expense of books, will, under the free text-book system, be brought within the influence of the school-room. Indeed, on general principles, it is difficult to see why the city or town that, on grounds of public policy and necessity, is required by law to provide school room and teachers and school appliances for children, ought not also to provide them with that most essential school appliance—text-books. Our own belief is, that experience will demonstrate that the free text book system is not only justified on grounds of economy, but also by the wisest public policy.'

"We will only add that the measure, where adopted, has been found to be a popular one. It relieves from expense, anxiety, and trouble, and could not be otherwise than popular. The leading, wealthiest, and most intelligent citizens are its most earnest advocates. We are confident, also, that should other towns and cities adopt the same plan and proceed with it judiciously, it would be found equally satisfactory.

"Yours, very truly,

"THOMAS TASH."

The following is an extract from the last report of the City of Bath:

"SCHOOL BOOKS.—The present makes the fifth year since the city began to furnish school books for the entire children of the city. For convenience sake, it may, perhaps, be as well to give here the cost to the city of school books each year:

First year	$1,582 52
Second year	2,795 40
Third year	1,224 08
Fourth year	1,674 44
Fifth year *	1,591 72

"At this time we have a larger amount of books on hand than at the close of either of the former financial years. It is probable, therefore, that the expenditure for the coming year will be somewhat less than the two preceding years. It will not, however, be much reduced, for, as the city increases, more books are required. Some books must also be constantly kept on hand to supply the immediate and continued demand.

"During the past year, the City of Lewiston has adopted the Bath plan of furnishing school books. I have no doubt that within a few years, more cities and towns will adopt the course that Bath has, and

* In eighteen hundred and seventy-three (fifth year) Bath had a school attendance of two thousand nine hundred and forty, making the city's expenditure for text-books a very little over fifty cents per child! In California, at least three dollars per child is annually spent for text-books!

furnish books to the children, so that the cost of education will be entirely reduced to ordinary taxation.

"From our five years experience in Bath, we can confidently recommend this plan to all cities in the State, as the best and cheapest method of providing school books. The towns and plantations will also find it to their advantage to adopt the same plan. The books can be purchased at low rates and used till worn out.

"In looking over the reports of the school committees of the cities, towns, and plantations of this State, in the State Superintendent's report, I find a very general demand for uniformity of text-books; either State or town uniformity. I suppose all are in favor of town uniformity. A large number are in favor of State uniformity, but chiefly for the sake of bringing about in that, as the most ready way, perfect town uniformity. It is much to be doubted whether there is any easier or more practical mode of bringing about town uniformity than the plan adopted in Bath. Uniformity in the town is perfect of course, for they are purchased and placed in all the schools by the committee. The chief reason in favor of State uniformity, is the saving of the expense of purchasing new school books to those parents who move from town to town. This expense will be obviated by the towns furnishing the school books. Parents who move from a town will leave their school books, of course, but have them furnished again by the town to which they move. They would suffer no loss, therefore, provided all the towns in the State furnish school books for the schools.

"The State Superintendent recommends the 'Bath plan' as on the whole the best solution yet devised of the vexatious question of 'text-books,' 'State uniformity,' etc. This matter has been before the Legislature for several years, and there seems to be a tendency toward acquiescing in the plan adopted in this city. I hope it will be adopted throughout our State."

HOW TO OBTAIN TRAINED TEACHERS.

No question connected with our school system is beset by more difficulties than that which relates to the supply of competent and trained teachers. It is unnecessary to enumerate the reasons which have left in America, "the highest and most responsible of all occupations to the ignorance, the conceit, the dullness, or the inexperience of the chance comer and amateur." There are none too young, too old, too feeble, too sickly, too unqualified in any or every way, to regard themselves, and to be regarded by others, as unfit for school-keeping. Fortunately, there is a general aptitude for the work of teaching peculiar to Americans; and we find, therefore, some of the best teachers in the world, produced under a system which makes it possible for us to have the very worst teachers, or rather school-keepers, which can be produced by a system which improvises the untrained and inexperienced youth into members of a profession in which, as Dr. Channing says, more wisdom is required than to govern a State.

I shall also waste no words to prove that teachers need a professional training as much as doctors and lawyers, not to mention shoemakers and tailors. It has taken long years, but at last we have obtained a popular

recognition of the necessity of training and apprenticing our teachers as well as our bricklayers and carpenters. But to devise a practical plan of doing this is a problem of no ordinary magnitude.

Our schools required last year, in round numbers, twenty-seven hundred teachers. Of this number, not one fifth had been trained and prepared for their work; the rest were composed of persons who, when entering upon the work, were without experience, and without training; and this large number is constantly recruited by "chiefly young persons, without experience, and without special adaptation, whom necessity, or accident, or friends, or fate, has transformed into school-masters and school-mistresses for the nonce." The examinations through which all recruits to the profession are required to pass in this State, are certainly not a course of training for the profession; and I showed already in my last report, and in the *California Teacher* since, how the most perfect system of examination, even when honestly and unflinchingly executed, will give us no *qualified* teachers; *trained* and *skilled* teachers, of course, can only be produced by normal and training schools. Experience has proved that the most comprehensive system of State, city, and county examinations, has met with but very limited success in supplying our schools with qualified and well prepared teachers.

To supply well prepared teachers for all the schools, is still an unsolved problem. Of course, the shortest and complete solution of the problem would be to require each candidate for the profession to pass through a normal school; but this is impracticable, if for no other reason than that normal schools cannot be multiplied fast enough to keep abreast of the wants of our schools, even if the people and Legislature could be persuaded to make the necessary appropriations. Now, while it is not practicable to increase the number of schools of the existing pattern sufficiently to meet the requirements of our public schools, the want may be partially met through existing public and private institutions of learning. To make this solution of the problem understood, I give the system of providing qualified teachers recommended by the Committee on Normal Training Schools, at the meeting of the National Educational Association, held in eighteen hundred and seventy-two. The recommendations of the committee were:

"1. That in each university throughout the country there be established a school or faculty of education, in which the nature, ends, means, history, and literature of that subject shall be thoroughly taught, and in which the principles and methods appliable to higher education should receive their appropriate share of attention.

"2. That in every college and high school there be a professorship of education and didactics, under the operation of which the true theory of education, its relations to the individual and to society, together with its history in our own country, including its rise, progress, present condition, and legislation, shall be taught to every student.

"3. That in every State there should be established, according to its population and resources, one or more normal schools or colleges of a high order, for the special training of teachers for high schools, for the elementary normal school hereinafter named, and for the preparation of Superintendents of Schools, and others.

"4. That these higher normal schools should be supplemented in each county, when practicable, by an elementary normal school supported by the county, with State aid, if such can be secured, for the training of those teachers who are to be employed in the primary and

intermediate grades of instruction, and the mixed schools of the rural districts.

"5. That, in addition to the foregoing, there should be held in every county, when its population is sufficient to warrant it, at least one normal institute in each year, the session to continue from two to six weeks, in order to afford the means for professional instruction to all who are unable to avail themselves of the more permanent advantages of the training schools. Attendance upon these institutes by those who have not enjoyed the benefits of the normal schools should be so far compulsory as to be made a condition of the employment of all teachers who cannot show, upon a careful examination, an equivalent of the professional knowledge imparted in them. The institutes should be under the joint tuition of the County Superintendents and the instructors of the training schools."

With these recommendations before us, a system appliable to the conditions of our State can be devised which will meet our present wants and those of the near future. My recommendations, which, I think, will be found of easy application, are:

First—That in our State University be established a school or faculty of education with a four years' course of study; all students completing and passing a satisfactory examination in the first year's course, to obtain a life certificate entitling them to teach any primary or third grade school in the State; all students completing and passing a satisfactory examination in the second year's course, to obtain a life certificate entitling them to teach any school in the State not above the intermediate or second grade; all students completing and passing a satisfactory examination in the third year's course, to obtain a life certificate entitling them to teach any school not above the grammar or first grade, and to be eligible to the office of City or County School Superintendent; all students completing and passing a satisfactory examination in the four years' course, to obtain a life diploma entitling them to teach in any school of the State, including high schools, normal and training schools, and the Educational College of the University, and making them furthermore eligible to the office of State Superintendent and instructors of normal institutes.

Second—That the course of study of the State Normal School be conformed to the one just sketched.

Third—That any high school or college, private or public, be authorized to establish a normal school department, with a partial or full course of study as prescribed for the educational college of the University, provided that such department be taught only by graduates of the four years' course; that the course be the same as provided for the State Normal School, and that the students be examined and certificated only by the faculties of the State Normal School and University. If such department be connected with a public institution, tuition to be free.

Fourth—That any City Board of Education, or County Board of Supervisors, be authorized to establish city or county normal schools, teaching partially, or in full, the course above mentioned, but their students to be examined and certificated only by the faculties of the State Normal School and University.

It might be advisable to grant special State aid to all private institutions of learning which establish normal departments, subject to State

authority as above indicated, although I am of the opinion that no such incentive is needed, as many private and denominational colleges have now already established normal departments, and will be willing, perhaps, to submit to the conditions named in order to have the graduates of such departments certificated as public school teachers.

Of course each institution, whether public or private, establishing a normal school department, must establish or have control over a training or model class, which can easily be supplied by the school authorities of the place where the institution is situated.

After we have obtained by these means a sufficient supply of qualified and trained teachers, only the graduates of such normal departments or schools must be allowed to become public school teachers.

During the interim we must have recourse to "normal institutes," which assemble for a longer period than our present teachers' institute, and in which the instruction is more exclusively technical. However valuable these institutes are as aids, they cannot supply the place of regularly organized normal schools or normal departments; and can only serve as makeshifts until such times as normal schools or departments are established in sufficient numbers to meet the wants of the State.

As is well known we have a system of teachers' institutes. These differ from normal institutes in the length of session, the latter being continued in session from two to six weeks, and in the kind of instruction. Without depreciating the value of teachers' institutes, I deem it advisable to suggest that these teachers' institutes be changed into normal institutes.

Perhaps Wisconsin has the most liberal law on the subject of normal institutes. The general laws of eighteen hundred and seventy-one provide that "normal institutes for the instruction of teachers shall be held each year in such counties of the State as may be designated by the State Superintendent, with the advice of the Board of Regents of normal schools, preference being given to such counties as receive least direct benefits from the normal schools. Each of said institutes shall be held for at least four consecutive weeks, under the direction of the County Superintendent, assisted by such person or persons as the State Superintendent may appoint. The course of study pursued in said institutes shall, as far as practicable, be uniform, and shall be prescribed by the School Superintendents of the counties in which said institutes are held, with the advice and approval of the State Superintendent." A sum not exceeding two thousand dollars is appropriated to carry out the provisions of the Act.

In regard to the cost of the proposed normal institutes, it will be found that it will not be as great as the cost of our present Teachers' Institutes and Boards of Examination. Thus our Boards of Examination cost for eighteen hundred and seventy-five, nearly fourteen thousand dollars; our Teachers' Institutes nearly three thousand dollars; and these seventeen thousand dollars spent for normal institutes will furnish us a powerful and efficient means not only for instructing and inspiring the teachers already certificated, but also for giving some training to those desirous of being certificated. The amount is large enough to give us yearly at least a dozen normal institutes; and each section of the State can thus be reached every year. My plan for the establishment of normal institutes is as follows:

1. The present Teachers' Institutes and Boards of Examination are replaced by normal institutes.

2. Normal institutes are to be held annually in such places as may be determined upon, either by statute or by authority conferred upon the State Superintendent or other officer or Board.

3. Every normal institute must be continued in session for not less than four weeks. It must be under the direction of a teacher who is known or proved to be a thorough normal school instructor; such teacher to be appointed by the State Superintendent, or other officer or Board, as may be deemed best. Each of the teachers engaged in the State Normal School or the educational college of the University, must conduct annually at least one normal institute.

4. Every applicant for a teacher's certificate must be present at the beginning of a normal institute; his admission as a member of the institute must be upon an examination like that required of applicants for admission into the State Normal School; he must attend the institute at least one full term; and must pass, at the end of the term, a satisfactory examination in the instruction given during the institute.

5. The expenses of the institute are to be paid direct by the State, or from the unapportioned County School Funds of the counties comprising the district in which the institute is held.

I have thus given the merest sketch of a system of normal institutes which can easily and profitably be introduced into this State. From this sketch, an appropriate system can readily be elaborated; but as so much depends upon the temper and view of the Legislature, and its Committees on Education, it is preferable to leave such elaboration till the time when such committees can act upon the matter.

To show the work which is performed by normal institutes, and how such work will at least partially prepare and train applicants for teacher's certificates, I copy the institute programme used in Wisconsin, giving all the details in full. If applicants, after passing a preliminary examination to prove them possessed of the *knowledge* requisite to a school teacher, have worked through such a programme, they have obtained at least some *skill in teaching*, and are, perhaps, as well prepared as they can be without passing through a normal school. The following programme is worthy of study by all who are interested in the question of the qualifications of our teachers.

INSTITUTE PROGRAMME—First Week.

Time.	Exercise.	Monday.	Tuesday.
8.45 A. M.	Opening Exercises.	....	....
9.00	Class work.	....	Arithmetic—Fundamental Rules.
9.45	Methods.	....	Primary Arithmetic.
10.30		Recess.	Recess.
10.45	Class work.	....	Reading and Spelling.
11.30	Methods.	....	Primary Reading.
12.00 M.		Intermission.	Intermission.
1.30 P. M.	Class work.	Organization and Spelling.	Geography of Wisconsin.
2.15	School management.	Art of Teaching.	Organizing Mixed Schools.
3.00		Recess.	Recess.
3.15	Model Class.	Teacher appointed by Conductor.	Teacher appointed by Conductor.
4.00		Miscellaneous.	Miscellaneous.

SECOND WEEK.

Time.	Exercise.	Monday.	Tuesday.
8.45 A. M.	Opening Exercises.	....	....
9.00	Class work.	Arithmetic—reduction.	G. C. D. and L. C. M.
9.45	Methods.	Penmanship.	Penmanship.
10.30		Recess.	Recess.
10.45	Class work.	Reading and exceptions to rules for Spelling.	Reading and use of Dictionary.
11.30	Methods.	Composition.	Letter Writing.
12.00 M.		Intermission.	Intermission.
1.30 P. M.	Class work.	Geography of United States.	History of U. S., Spanish Colonies, Claims and Settlements.
2.15	School management.	Recitation—Methods and Objects.	Reviews.
3.00		Recess.	Recess.
3.15	Model class.	Teacher appointed by Conductor.	Teacher appointed by Conductor.
4.00		Miscellaneous.	Miscellaneous.

INSTITUTE PROGRAMME—First Week.

Wednesday.	Thursday.	Friday.
....	....	....
Mental Arithmetic.	Notation and Numeration and Definitions.	Classification of Numbers.
Drill in Mental Arithmetic.	Number Lessons.	Factoring.
Recess.	Recess.	Recess.
Reading and Spelling.	Reading and Spelling.	Reading and Rules for Spelling.
Intermediate Reading.	Language Lessons.	Language Lessons.
Intermission.	Intermission.	Intermission.
Outline Map of Wisconsin.	Geography of North America.	Outline of Map of North America.
Programme.	Warming and ventilation of school-room.	Seating, movements of classes—Records.
Recess.	Recess.	Recess.
Teacher appointed by Conductor.	Teacher appointed by Conductor.	Teacher appointed by Conductor.
Miscellaneous.	Miscellaneous.	Miscellaneous.

SECOND WEEK.

Wednesday.	Thursday.	Friday.
....	....	....
Common Fractions.	Common Fractions.	Percentage.
Oral instruction—Gulf Stream.	Drawing.	Drawing.
Recess.	Recess.	Recess.
Reading and use of Dictionary.	Reading and Word Analysis.	Reading and Word Analysis.
Calisthenics.	Calisthenics.	Calisthenics.
Intermission.	Intermission.	Intermission
United States History—Treaties.	Causes and events leading to the civil war.	Closing exercises.
School Government.	Qualifications of Teachers.	
Recess.	Recess.	Recess.
Teacher appointed by Conductor.	Teacher appointed by Conductor.	Teacher appointed by Conductor.
Miscellaneous.	Miscellaneous.	Miscellaneous.

INSTITUTE WORK, 1874.

TO THOSE PERSONS WHO CONDUCT AND THOSE WHO ATTEND INSTITUTES.

The work of training the youth of this State to habits of thought, industry, and usefulness is one of grave importance.

Properly to lay the foundations of true greatness, broad and deep, so that good citizenship shall result, is worthy of careful attention.

Considerable time and money are being expended by the State in order to prepare teachers for their duties.

A meeting of gentlemen interested in the work was called at Madison, July 10–14, to mature the Institute work for the State, that there might, if possible, be unity of effort. After careful consideration, the accompanying schedule has been prepared to guide you in your duties.

While considerable time ought to be given to methods of presentation and detail of plan, yet much *class work* is needed, so that the subject taught, as well as the *manner of teaching*, shall be well understood. In this a *clear comprehension* of a subject does not necessarily involve minuteness of detail.

The *quality* and not the *quantity* should be the aim, in the short time allowed. To accomplish this, the Institute must be, as far as possible, a *model school.*

The recitations should be models; the *manners, deportment, and punctuality*, models. Thus the spirit emanating from these meetings will permeate the subsequent life of each teacher.

As a great amount of work is laid out, it is recommended that the class be numbered, and divided into two sections by the even and odd numbers.

No. 1 reciting one day in *Reading, Geography, Grammar*, and No. 2 listening; the same day, No. 2 reciting in *Arithmetic, Spelling*, and *History*, while No. 1 is listening. The next day, No. 1 recites in *Arithmetic, Spelling*, and *History*, and No. 2 in *Reading, Geography*, and *Grammar*.

In this manner a healthy competition will secure in recitations a fair standard of perfection, while the pupils will not be overburdened with so *much* work as not to do *any well.*

In case the Institute numbers less than fifty members, it shall be in the discretion of the Conductor to make one class and diminish the number of branches.

It is recommended that the *conductor* and *assistant* shall prepare each day a scheme of the work they wish to accomplish, so that there may be *point* and *freshness* in the recitation.

Also, that but one evening lecture per week be given, as the evenings should be devoted to study and preparation for the daily work.

Also that *one* daily exercise in class work be conducted as a *model*, by a pupil, to be followed by criticism from critics previously appointed.

Each conductor shall cause a full record of *attendance, deportment*, and *plan of daily work* to be made, and at the close of the Institute, forward to the State Superintendent at Madison. Conductors will also prepare and forward to Madison, reports covering, as far as possible, the following points:

(I.) Any modifications of syllabus, and reasons.
(II.) Measures taken to secure *punctuality, good deportment*, and *attention*, with results.

(III.) Recitations:
(*a.*) Means to secure *accuracy and promptness.*
(*b.*) Result as regards (1) Memorizing. (2) Original thought.
(*c.*) Topical and Individual.
(*d.*) Catechetical and Individual.
(*e.*) What coöperation allowed on the part of class or teacher.
(*f.*) What aid given before recitation.
(IV.) Alternation of sections—results.
(V.) Average age of teachers.
(VI.) Average experience of teachers.
(VII.) Proportion of sexes.
(VIII.) Proportion of old and new members.
(IX.) Amount of time devoted to study.
(X.) Moral and social condition of members:
(1.) In class room. (2.) At recesses. (3.) In the community.

To this schedule is appended a programme of *study* and *recitation* in mixed schools, not as a pattern but as a suggestion. Also a scheme for the study of botany for one term.

SYLLABUS.

SCHEDULE OF DAILY WORK.

	Minutes per day.	Hrs. Mins per week.
1. Reading	45	3.45
2. Arithmetic	45	3.45
3. Geography	35	2.45
4. Spelling and Analysis of Words	25	2.20
5. Penmanship and Drawing	20	1.40
6. Grammar	35	2.55
7. History and Constitution	40	3.20
8. Opening Exercises, Roll-call	12	1.15
Recesses	26	2.30
9. Vocal Music, if practicable; if not, the time to be given one half to Physiology, one quarter to Botany, and one quarter to Biography	15	0.50
10. Critical Class Drill, Criticism	30	2.30
11. Methods of Teaching, Theory and Art, Lecture or Discussion	30	2.30

Morning session begins at 9 o'clock.
Afternoon session at 1.30 o'clock.

READING.

Time, forty-five minutes—divided into two parts—(*a*) first part, twenty-five minutes, (*b*) second part, twenty minutes.

FIRST WEEK.

Second Day. *First Part.*—Lecture on importance of Reading, and on the manner of treating cases of *Defective Articulation.*

Second Part.—*Powers* and *Markings* of *a.*

Third Day. *First Part.*—Method of conducting recitations in *Primary Reading* (1) with reference to *beginners;* (2) with reference to First and Second Reader Classes.

Second Part.—*Powers* and *Markings* of *e* and *i.*

Fourth Day. *First Part.*—Continuation of third day's work.

Second Part.—*Powers* and *Markings* of *o* and *u.*

Fifth Day. *First Part.*—Drill in *Spelling* by sound.

Second Part.—Written review of above second-part work, with *five* words to illustrate each vocal element.

SECOND WEEK.

First Part.—During the remainder of the term, give attention in every exercise to *analyses of thought*, and let that be followed by reading, with reference to the *laws of expression.* Confine the reading this week to *one descriptive* or *narrative* selection, with special attention to *Pitch.*

Second Part.—The letters representing *Vocal Sound*, called *Vocal Substitutes*, with *five* illustrative words for each sound.

THIRD WEEK.

First Part.—Read an *argumentative* piece, giving attention to *Rate* and *Force.*

Second Part.—Classification of consonants, *Powers* and *Markings.*

FOURTH WEEK.

First Part.—Read *one* piece in Verse or one in Dialogue, giving attention to *Qualities of Voice* and to manner of breathing, *Effusive*, *Expulsive*, and *Explosive*, with written review of the whole.

Second Part.—Powers of *vowels* in *unaccented* syllables, with drill on *accent*, with written review of the whole.

ARITHMETIC.

Forty-five minutes daily.

FIRST WEEK.

Primary Arithmetic.

Development of the idea of number, by Addition, by Subtraction, by Multiplication, and by Division, using objects.

Fundamental principles established. Especial attention given to verification. Abstract numbers. Drill exercises in Addition, Subtraction, Multiplication, and Division.

Reading written abstract of work for the week. In this abstract, specific illustration to be required.

SECOND WEEK.

Mental Arithmetic.

Practice in performing fundamental operations with rapidity, giving results only.

Problems involving Addition only.
Problems involving Subtraction only.
Problems involving Addition and Subtraction.
Problems involving Multiplication only.
Problems involving Addition and Multiplication.
Problems involving Subtraction and Multiplication.
Problems involving Addition, Subtraction, and Multiplication.
Problems involving Division only.
Problems involving combinations as above with Division.
Reading of written abstract of work for the week.

NOTE.—After a problem given by the teacher has been solved, let the pupil make and solve one of similar structure.

THIRD WEEK.

Practical Arithmetic.

Definitions, Notation, and Numeration.
Classification of numbers.
Addition and Subtraction:

1. Simple Numbers.
2. Decimals.
3. Common Fractions having same denominator.
4. Compound Denominate Numbers, not involving fractions.

Factoring. Divisibility of Numbers.
Greatest Common Divisor and Least Common Multiple of whole numbers and fractions.

FOURTH WEEK.

Reduction, ascending and descending, of Denominate numbers and of Common Fractions.

Multiplication and Division of Denominate numbers and of Common Fractions.

Change from Common Fractions to Percentage; Problems in percentage.

NOTE.—When the solution of a problem requires several operations, let one member of the class give the verbal analysis, another put this in proper form on the blackboard, and a third find the result in its simplest form.

GEOGRAPHY.

Time, thirty-five minutes.

FIRST WEEK.

Facts of Personal Observation.

Monday.—Land Features; as *hills, valleys.* Water Features; *springs, brooks, rivers, lakes.*

Tuesday.—Productions—Vegetable; *herbs, trees.* Animal; *domestic, wild.* Mineral; *rocks, soils.*

Wednesday and Thursday—Direction and Distance, Cardinal points. Development of the conception of *linear* units; *foot, rod, mile.* Application in *school-room; school grounds.*

Friday.—Definition and distinction of Town and Township. Illustrate by reference to the county map.

SECOND WEEK.

Monday.—County; Surface, *land, water.* Productions; *vegetable, animal, mineral.*

Tuesday.—Form of the Earth, proofs.

Wednesday.—Mathematical Geography; Principal Lines, their *position* and *use.*

Thursday.—Definition and length of a *degree,* Latitude, Longitude. Determine relative lengths in Wisconsin.

Friday.—Motions of the Earth; Alternations of *day* and *night,* change of seasons. Causes.

THIRD WEEK.

Monday.—Draw map of Wisconsin (outline).

Tuesday.—Complete Map of State, fixing its Latitude and Longitude, locating chief rivers and railroads, ten chief cities and the county.

Wednesday.—Discuss *Surface;* Land, water, *soil, climate.*

Thursday.—Vegetables, Animals, Minerals.—*Exports, imports.*

Friday.—Population; *Amount, race, character.* Civilization; *Wealth, intelligence, education, morality.*

FOURTH WEEK.

Monday.—In one or more *squares,* 20 inches on a side equaling 400 miles, place outline sketches of Islands, Lakes, States, as *tests* in comparative area.

Tuesday.—Outline map-work on United States. Boundary Features. Natural, arbitrary.

Wednesday.—Surface; Mountain systems, *plateaus,* rivers and river systems.

Thursday.—States, territories, capitals, and chief cities.

Friday.—Review.

ORTHOGRAPHY.

Time, twenty-five minutes daily.

FIRST WEEK.

Lists of twenty-five words in common use to be written each day; the words selected to be those not spelled according to rule, but frequently misspelled. One or more of these lists may consist of geographical names often used. Oral review, each day, of the previous lesson.

SECOND WEEK.

Rule of Spelling.—"Silent *e* final, of a word, is dropped before a suffix beginning with a vowel." Spell lists of words falling under the rule, and of exceptions. Require pupils to bring in short lists of words exemplifying the rule, and each law of exception to the rule. Oral reviews as in the previous week.

THIRD WEEK.

Word Analysis.—Some of the more common and useful prefixes, suffixes, and roots to be learned each day. Derivatives to be formed, observing the rules of spelling, and definitions to be derived.

FOURTH WEEK.

Word Analysis.—Continued for three days.

Fourth day.—Lecture on the use of the Spelling Book, use to be made of the lists of words of similar and opposite meanings, etc.

Fifth day.—General spelling-down exercises, no words to be used but those given in the lessons of the Institute.

PENMANSHIP.

Daily Exercises—Time, twenty minutes, two weeks.

First Day.—Specimen of Penmanship secured from each member of Institute. Attention given to position of hands, feet, body, and manner of holding pen. Movement drill five minutes.

NOTE.—This movement drill for five minutes should precede each day's work.

Second Day.—SLANT; Make lines one, two, and three units in length, a portion of the class at the board. Write on board and paper. Criticism confined to slant.

Third Day.—HEIGHT; Comparative height of letters, *u* taken as the standard. Scale formed. Writing on board and paper. Criticisms confined to *slant and height.*

Fourth Day.—FORM; Analysis of small letters *i, u, w.*

Fifth Day.—FORM; Analysis of small letters, *a, l, g, f.*

Sixth Day.—FORM: Capital principles and analysis of capitals.

Seventh Day.—Right and wrong forms of letters illustrated. Tests applied to specimens presented the first day. Methods of criticisms exemplified and applied.

Eighth, Ninth, and Tenth Days.—Class drill to represent ordinary school work.

DRAWING.

Time, twenty minutes.

FIRST WEEK.

1. *Monday*—Lines; vertical, horizontal, oblique.
2. *Tuesday.*—Measurement of lines. Scale taught.
3. *Wednesday.*—Combination of two lines to form angles, right angle, obtuse angle, acute angle.
4. *Thursday.*—Combination of three lines to form triangles, right-angled, equilateral, isosceles, and scalene. (Particular attention given to equilateral and isosceles triangles.)
5. *Friday.*—Formation of designs from triangles, by arrangement around a common center. (Work inventive.)

SECOND WEEK.

6. *Monday.*—Quadrilaterals, names. (Work inventive.)
7. *Tuesday.*—Formation of designs by arrangement of quadrilaterals around a common center. (Work inventive.)
8. *Wednesday.*—Formation of designs from triangles and quadrilaterals combined. (Work inventive.)
9. *Thursday.*—Outlines of familiar objects by the use of straight lines. (Class work imitative.)
10. Outline of curved-line drawing.

GRAMMAR.

Time, twenty-five minutes, daily.

FIRST WEEK.

First Day.—State the province of Grammar; show *what* may be taught to young pupils, and *how* to teach it.

Second Day.—Have class bring in different kinds of sentences and analyze, chiefly with reference to the thought.

Third Day.—NOUN; Its functions, forms, positions, classification, treated orally in the class with blackboard illustrations.

Fourth Day.—The teachers to bring in the same subject properly arranged on paper with sentences illustrative of each point. The papers to form subject of that day's lesson.

Fifth Day.—ADJECTIVE; Functions, classes, forms, position, with sentences illustrative, by teachers. Examples of false syntax by conductor to be corrected by class.

SECOND WEEK.

First, Second, and Third Days.—PRONOUN; Functions, classes, forms, positions, with illustrative sentences. Special attention to the different functions of the pronoun and correspondingly different forms. Examples of false syntax by conductor to be corrected by class.

Fourth and Fifth Days.—ADVERBS; As before, with adjective and adverbial phrases and clauses. Sentences by conductor illustrative of false syntax, both in form and position, to be corrected by class.

THIRD WEEK.

VERB; Functions, classes with regard to form, with regard to signification; changes of form (in this and all other cases, the reason of the changes to be given); relation to and influence upon other words. Illustrative sentences by teachers; sentences by conductor to be corrected by class, with reasons therefor. In all the papers by the pupils, strict regard to be had to neatness, order, penmanship, capital letters, spelling, and punctuation, that the grammatical exercises may be eminently practical exercises in composition.

FOURTH WEEK.

Phrases and clauses used as substitutes for the noun, adjective, and adverb. Special attention to the syntax of such.

A paper from each teacher embodying the salient points of all the previous work. One or more of these to be examined in class as text for an oral review.

Consideration of a few of the principal rules for agreement and government.

Last Day.—Review the work. Bring to the notice of the class any difference of treatment that the subject may require in school, from that in the Institute.

HISTORY.

Time, forty minutes daily, two weeks.

I. 1. Discovery, with historical causes.
II. 2. Claims derived from discovery and settlement.
3. Transfers of territory.
4. The colonies; royal, proprietary, and charter.
III. 5 and 6. Two administrations. (Jefferson's and Jackson's recommended.)
IV. 7. Causes and events leading to the civil war.
8. Analysis of campaigns in the East.
9. Do. in the West.
10. Results of the war up to the present time.

Each lesson should be analyzed on the blackboard, and the Outline Map should be constantly in use. The main points only of each lesson should be held to, and minor parts omitted.

CIVIL GOVERNMENT.

Time, same as History, two weeks.

1. Historical sources (1) English, (2) Colonial constitutions, and (3) Articles of Confederation.
2. Citizenship and naturalization.
3. Electorship (the first process of representation.).
4. *Legislative.* Qualifications and manner of election of Senators and Representatives. Compare State Legislatures.
5. Process of law-making, in Congress and Legislatures.

6. *Executive.* National and State.
7. Administrative officers, foreign and domestic. Compare State officers.
8. *Judiciary*, National and State.
9. County and town organization.
10. General review.

ALGEBRA.

Time of recitation, forty-five minutes, outside of regular institute work.

First Day.—Connection of Algebra and Arithmetic. Illustrations.
Second Day.—Connection of Algebra and Arithmetic. Illustrations.
Third Day.—General Definitions; Classify Symbols.
Fourth Day.—Review; Idea of *Positive and Negative Quantities.*
Fifth Day.—Addition; Relation to Arithmetic. Cases. Axioms or Principles.
Sixth Day.—Subtraction; Cases, law of Signs, Axioms or Principles.
Seventh Day.—Multiplication; Law of Signs, relation to Arithmetic.
Eighth Day.—Multiplication; Law of Exponents.
Ninth Day.—Multiplication of Binomials.
Tenth Day.—Multiplication Theorems I, II, III.
Eleventh Day.—Division, Laws of Signs.
Twelfth Day.—Division, Laws of Exponents.
Thirteenth Day.—Theorem $x^0=1$.
Fourteenth Day.—Theorem $H^m=\frac{1}{H^{-m}}$.
Fifteenth Day.—Factoring; Monomials, Binomials.
Sixteenth Day.—Factoring, Binomials.
Seventeenth Day.—Greatest Common Divisor and Least Common Multiple.
Eighteenth Day.—Fractions; Reduction, ascending, descending.
Nineteenth Day.—Symbols of 0, ∞, $\frac{0}{0}$.
Twentieth Day.—Review.

GEOMETRY.

First Day.—Introduction; idea of line, surface, solid.
Second Day.—Definition and classification of lines and angles, and formation of polygons, especially triangles.
Third Day.—Review; axioms.
Fourth Day.—Theorem treating of straight lines and their intersections.
Fifth and Sixth Days.—Same subject.
Seventh Day.—Triangles and their classification.
Eighth, Ninth, Tenth, Eleventh, and Twelfth Days.—Theorems (one per day) relating to triangles.
Thirteenth Day.—Quadrilaterals; classification.
Fourteenth, Fifteenth, Sixteenth, and Seventeenth Days.—Theorems relating to quadrilaterals.
Eighteenth Day.—Polygons; classification and theorems.
Nineteenth Day.—Theorem or problem.
Twentieth Day.—Review.

NATURAL SCIENCES.

In view of the difficulty attending the introduction of new branches of study into mixed schools of the State, it is recommended that work be done upon Botany and Physiology only; the former in the Summer months, and the latter in the Winter.

PLAN OF WORK FOR BOTANY.

I. *Leaves.*—(1) Parts. (2) Form. (3) Venation. (4) Margin. (5) Kinds. (6) Arrangement on stem. (7) Use.
II. *Flowers.*—(1) Parts. (*a*) Sepals. (*b*) Petals. (*c*) Stamens. (*d*) Pistils. (Seed vessel.) (2) Form, color. (3) Arrangement on stem. (4) Purpose of. (5) Adaptation of parts to purposes.
III. *Stem.*—(1) Parts. (2) Modes of growth. (3) Kinds. (4) Uses.
IV. *Roots.*—(1) Parts. (2) Kinds. (3) Uses.

NOTE.—In nearly every advance step in *term* or *classification*, let the specimen be in the pupil's hand. Let a constant *review* be kept up by a description of leaves and flowers previously presented by the pupil, naming the plant described, where known; *e. g.*, "The leaf of the elm is ovate, doubly serrate, rough," etc.

PROGRAMME FOR MIXED SCHOOLS.

A. M.	RECITATION.	STUDIES.
9.00	Opening Exercises.	
9.10	General Exercise. Number.	
9.15	Primary Class	"A" Arithmetic; 1st, 2d, and 3d Reader.
9.25	First Reader	"A" Arithmetic; Primary Class print; 2d and 3d Reader.
9.35	Second Reader	"A" Arithmetic; 3d Reader.
9.50	Third Reader	"A" Arithmetic; Recess for 2d Reader class.
10.05	"A" Arithmetic	"B" Arithmetic; 1st and 2d Reader write numbers.
10.25	Penmanship.	
10.45	Recess.	
11.00	"C" Arithmetic (Oral)	"A" Geography; "B" Arithmetic.
11.15	"B" Arithmetic	"A" Geography.
11.35	Primary Class	"A" Geography; Language Class.
11.45	"A" Geography	Language Class.
P. M.		
1.00	Language Lesson	State Work for Primary Class; Fourth Reader.
1.15	First Reader	State Work for Primary Class; "B" Geography; 2d Reader.
1.25	Second Reader	State Work; "B" Geography.
1.35	Fourth Reader	"B" Geography; 1st and 2d Reader draw.
1.55	Primary Class	"B" Geography; Grammar.
2.05	"B" Geography	Grammar.
2.20	History and Constitution	"B" Spelling.
2.40	Recess.	

2.55	Grammar	"B" Spelling.
3.15	"B" Spelling (Oral)............	"A" Spelling.
3.25	"A" Spelling (Written)......	2d and 3d Reader classes prepare for general exercise.
3.40	General Exercise: Biography one day in each week; Botany or Physiology, two days; outline maps, two days.	

THEORY AND PRACTICE.

Time, thirty minutes daily.

1. Certificate; contract; care of school-room; care of school grounds.
2. Classification. Programme.
3. Seating and movements of classes.
4. Records.
5. Warming and ventilation of school-room.
6. Recitation: (1) objects; (2) methods; (3) errors to be corrected; (4) aid.
7. Study: (1) adaptation to age and mental power; (2) methods; (3) incentives to *thought*, *observation*, and *study*.
8. Reviews: (1) how often; (2) of what character; (3) examinations.
9. Culture in manners and morals.
10. Oral Instruction: (1) when advisable; (2) subjects thus best taught; (3) methods best adapted.
11. Government: (1) authority whence derived; (2) legal and moral aspects; (3) influence of different modes upon the character of pupil and teacher; (4) causes of disobedience; (5) peculiar obstacles and aids; (6) influence of *enthusiasm*, *energy*, and *integrity* in teacher, upon government; (7) rights and duties of teachers, pupils, parents, and school officers.
12. Manners of teachers in school.
13. Teacher's employment of time out of school: (1) rest; (2) recreation; (3) mental and social culture.
14. Care of pupils in regard to food, dress, recreation, sleep, labor.
15. Specific modes of teaching:
   (1) Reading. Primary, Intermediate.
   (2) Arithmetic. Primary, Intermediate.
   (3) Language.
   (4) Geography. Primary, Higher.

HALF-TIME SYSTEM OF SCHOOLS.

This system has been tried with encouraging results in Europe, and also in several cities of the United States. The advantages of this system are, that it places school facilities within the reach of many children now deprived of them by the absolute necessity of devoting at least a part of each day to labor, and that it doubles the number of pupils instructed, with no addition to the cost.

In the United States, the application of this system has been thus far confined, I believe, to primary schools. In such schools it is undoubtedly of great advantage, if not a necessity, as I am inclined to think. The half-time pupils have proven, as a rule, as apt scholars as their full-time classmates. The following extracts from the Taunton (Mass.) School Report will show some of the results of the system:

"Another difficulty which has long prevailed in our [Taunton] schools, and particularly those of the primary grade, is that there have been too many pupils in a room. To remedy this we have adopted, in some of the largest primary schools, the half-time system. About one half of the pupils attend in the forenoon, and the other half in the afternoon. It has proved more successful than was anticipated by the committee. Children of this grade have not become accustomed to the restraints of the school-room, and, at that tender age, ought not to be required to sit the whole day in the foul atmosphere of a crowded primary school. They cannot study, nor can they receive the instruction or attention of the teacher, but a small portion of the time. They are compelled to spend a large part of the day in the effort to sit still and be idle, and if anything will dull the senses, or blunt the intellect, it is the enforced idleness in the midst of a poisonous atmosphere. They need pure air and exercise to strengthen the physical system, for upon that depends, in a great measure, their future mental strength. Under the half time system the air of the school-room is comparatively pure. The teacher spends less time in the discipline of the school, so that each pupil actually receives more of her attention and instruction than under the old system. As a practical result, we find greater progress on the part of the pupils, with less labor on the part of the teacher, and when the experiment has been tried long enough to afford a test, we expect to find better health among both teachers and pupils."—*Report of Committee.*

In California, the half-time system has been introduced into the primary schools of Oakland, thanks to the efforts of the City Superintendent, F. M. Campbell. This officer reports that eleven classes are taught upon this plan, and that the number of pupils taught by one teacher in these classes ranges from ninety to one hundred and seventy. Twenty per cent is added to the salary of the teachers who are required to teach these classes—a very commendable feature, and unique, I believe, to Oakland. It is the unanimous opinion of principals and teachers that the half-time pupils progress equally with the full time pupils. In the report of the Oakland schools (see *infra*) I give Mr. Campbell's excellent remarks on the subject of half-time schools, and recommend their perusal to all City Superintendents and Boards of Education.

If we inquire now whether the half-time system can be applied equally well to schools above the primary grade, the question is not easily answered. Leaving out of consideration the saving in the cost of our schools which this system effects—which should always be a secondary and not a primary consideration—it has not yet been satisfactorily determined whether, with a more rational method of instruction, the school-hours of all scholars above the primary grade are too long or not; or, in other words, whether our schools exact too much mental labor of our scholars. If, as a general rule, labor and schooling

could be united, or if we could devise a rational system of technical and industrial education, which could be united with our present system of education, the half-time system would unquestionably be an advantage and a necessity. If we could obtain universal recognition of the idea that labor must be united with schooling, then it might be shown that labor and schooling assist each other, and that children who devote their whole time for eight or ten years to schooling alone do not enter on manual labor with much enjoyment after leaving school. But in fact, "a great many of the pupils in city schools would not engage in manual labor the half of each day were the half time system adopted. If in school only half of the day, they would spend the other half in idleness, on the streets, and some in worse places. When no home study is required, the present system allows some eight hours a day and every Saturday for labor and recreation. This is found to be time enough for many children to do all the work that is provided for them. It is possible that it would be better if all our youth had regular work the half of each day, but the public schools cannot change the usages of society in this respect. They must conform to *what is* rather than to what *should be*."

The half-time system is undoubtedly adapted to the necessities of those who cannot give their whole time to school duties, and who are practically excluded from school under the present graded system. "The schools," says the *Christian Union*, "allow no divided allegiance. If the boy goes to school, he must go steadily, and give it the heart of the working days." It has, therefore, been suggested that half-time schools might be organized for working children, and that the present system be continued for others. But "this involves," says the *National Teacher*, "not only a classification but a *separation* of children on the basis of manual labor, and we have already quite enough of this class principle in the organization of our schools. With separate schools for colored youth, for German youth, for Catholic youth (so persistently asked for), and for working youth, the unity of the school system would be pretty effectively destroyed." The *National Teacher* adds, "that the difficulty under consideration can be successfully met without organizing separate schools for working children. What is needed is to make the course of study and the requirements of our schools flexible enough to accommodate this class of pupils. Instead of half-time schools, we would suggest *a half-time course of study*, in all grades above the primary; and this could be added with little difficulty. It is not necessary to require all the pupils in our public schools to take the same number of studies and advance with even step through the course. This procrustean device must be given up, if the public school system is to do its full legitimate work as an agency for the education of the whole people. Instead of excluding pupils who cannot meet all the conditions of a complete and thorough course of elementary education, it must provide for such pupils the best education possible under the circumstances. This may involve some loss in uniformity and system, but there will be a gain in usefulness—a result more important than mechanical perfection in classification. This half-time course should include the more important and essential branches of study, and it should be taken only by those who can attend school but half of the time, or who are physically or otherwise unable to take the regular full-time course. All abuses of the system should, of course, be carefully guarded against. There would probably be few applications at first for the half-time course, but it is believed that many working children, who cannot now

attend school, would avail themselves of its advantages when it is once known to be a practicable and fixed feature of the school system."

I append the two courses of study which are used in the Baden schools, "a short course, and an extended course; the former is arranged for working children who can attend but a part of each day. The short or 'simple' course prevails in rural and village schools which are organized on the half-time, or, more properly, the part-time system." The article was written for the *National Teacher*, by Professor William H. Young:

"A very striking feature of the Badish system, which prevails also in certain other German States, is worthy of special notice, as it renders the grading of village schools possible, that of town schools easy and complete, and suggests various school economies. There is a 'simple' or short course of common school instruction, requiring three to four school hours daily, and prevailing in the country and smaller towns and villages, and a 'broader' course, taking five to six hours daily, and prevailing in larger towns and cities. Attention is called to the former.

"While in American country districts and villages, pupils of all ages, from six to twenty-one, are in school about six hours daily for certain (Winter) months, and out of school, with teachers discharged and school houses closed, for the rest of the year, thus one teacher serving fifty to seventy ungraded pupils under every disadvantage for a part of the year, in Baden, one teacher instructs, in one school room, one hundred to one hundred and fifty pupils three to four hours daily during the entire year, with the great advantages of graded schools, eight unbroken years of daily instruction for every pupil, and constant and permanent employment for every teacher. Education becomes the *one business* of children, and teaching becomes a profession. By this system one teacher and one school room amply suffice for each one hundred and twenty pupils, or for each six hundred of population. It is enough to explain that certain classes of pupils attend only the forenoon session, and others only the afternoon session of the school; but, as German pupils *spend all their hours in school in actually receiving instruction*, or drilling under the teacher's immediate supervision and direction, each receives more of direct instruction during these three and four hour sessions than he could expect in the American ungraded school during the entire day. School hours begin generally at seven A. M. in Summer, and at eight A. M. in Winter—no great hardship, when it is remembered that the larger pupils may have their session forenoon, and the smaller ones in the more convenient afternoon. In scattered populations, where home and school house are far apart, where children work in factories, on the farm, or attend flocks, all these circumstances are considered in arranging school hours; every pupil having all his 'hours' confined to either the morning or afternoon session, and being the other half day subject to domestic calls. The various economies of such a system to pupil, teacher, parent, and community, in respect of time, money, and convenience, become manifest on a moment's reflection.

"The 'extended' or broader course of instruction calls here for no further remark.

"The hours per week assigned to each subject of instruction are as follows:

	'Simple' Course.	'Extended' Course.
1. Religion	3 hours.	3 hours.
2. German language	5 to 6 hours.	9 to 10 hours.
3. Arithmetic	3 to 4 hours.	4 to 5 hours.
4. Singing	1 hour.	2 to 3 hours.
5. Real Studies	5 to 7 hours.	6 to 8 hours.
Total, weekly	17 to 20 hours.	24 to 30 hours.

"Every week day is a school day, but Wednesday and Friday afternoons are generally 'free.' Physical training for boys and needlework for girls are always required, but generally confined to the half holidays, and not counted as 'school instruction.'"

SCHOOL HYGIENE.

"*The Health of Pupils in the Public Schools*" has been for years a fruitful theme of discussion in and out of the profession. On the whole, we have made some advances towards observing in our schooling the laws of health and physical development; but we are far from a satisfactory solution of the whole question. Perhaps the most important step taken in this matter has been by the American Social Science Association, which has matured a plan for investigating the subjects connected with school hygiene. Dr. D. F. Lincoln, the Secretary of the Health Department of the Association, describes the plan as follows:

"It was necessary in the beginning to analyze the subject; to distribute it by cutting it up into a convenient number of subsidiary subjects. Thirteen such divisions were made. The list is as follows:

"1. Heating and Ventilation.
"2. Light—and condition of the scholar's eyes.
"3. Seats—and deformities traceable to them.
"4. Architectural plans.
"5. Apparatus employed in instruction.
"6. Gymnastics.
"7. Condition of Nervous System.
"8. Organ of Hearing.
"9. Organs of the Pelvic Cavity.
"10. Drinking Water.
"11. Sewerage, and Water Closets.
"12. Commissioners for Scientific Inspection of Given School Areas.
"13. Project of a law establishing the office of Medical Inspector of Schools.

"Having done this, we attempted to assign the several topics to suitable persons, for separate investigation and report. Eight of the thirteen have now been assigned, in a more or less complete manner. No doubt it would have been easy to get workers to do the whole; but it is

possible that in so doing we should have lost more than we gained. For many obvious reasons, there was an advantage in not finishing the whole subject at a single blow; an ill selection, a confusion of principle, a hasty performance, unequal execution, irresponsible utterance of individual opinion, all had to be guarded against; and on the other hand, the best men are not always at leisure and at our command at precisely the time we might desire them, nor, if ready to aid us, are their powers always sufficient to complete a given task within a given time. These reasons are offered as excusing what might seem our shortcoming in not bringing forward a complete report on school hygiene this year.

"And I may add, that to our minds the subject in its various branches has assumed a size and an interest vastly beyond what it first had; and that plans of research have already come before us, which, if carried out, will take several years to finish.

"On the other hand, our numbers are not large, and our working power is very much concentrated in a few points at the East, particularly in Boston, where the department was reorganized two years and a half ago. This circumstance has also its advantages, in point of administration, as you will easily infer, though it has hampered us a little in the extension of our plans.

"A subject, when assigned as already stated, remains in the hands of the person to whom it is intrusted until he expresses his wish to present it to the Department Committee. A meeting of this committee is thereupon called, 'for the purpose of hearing and criticising' the paper in its then form. The process of criticism, I am happy to state, is performed willingly, and is borne with great good nature by its recipient, who, at the close of the evening, takes home his manuscript and his hints, to work up into a sort of second edition of the paper.

"Then, when the paper is finally ready for the public, its natural destination is to be read before a general meeting of the association, like the present; the daily press publish more or less of it, and the 'Journal of the Association" issues it in a corrected form within two or three months. It is not unlikely that the entire series of essays and reports, extending through several years, may furnish matter suitable for publication in a connected form. But of this it is not easy to speak at present, as but a few of the essays are completed.

"Two papers have undergone the process of revision, as described, and will be presented here, one upon 'School Gymnastics,' and one upon 'The Nervous System, as Injuriously Affected by Schools.'"

Touching the second subject of the list, the Secretary submitted, in outline, a set of

RULES FOR THE CARE OF THE EYES.

"When writing, reading, drawing, sewing, etc., always take care that:
"(*a*) The room is comfortably cool and the feet warm;
"(*b*) There is nothing tight about the neck;
"(*c*) There is plenty of light, without dazzling the eyes;
"(*d*) The sun does not shine directly on the object we are at work upon;
"(*e*) The light does not come from in front; it is best when it comes over the left shoulder;
"(*f*) The head is not very much bent over the work;
"(*g*) The page is nearly perpendicular to the line of sight—that is,

that the eye is nearly opposite the middle of the page; for an object held slanting is not seen so clearly;

"(*h*) That the page or other object is not less than fifteen inches from the eye.

"Near-sightedness is apt to increase rapidly when a person wears, in reading, the glasses intended to enable him to see distant objects.

"In any case, when the eyes have any defect, avoid fine needlework, drawing of fine maps, and all such work, except for very short tasks, not exceeding half an hour each, and in the morning.

"Never study or write before breakfast by candlelight.

"Do not lie down when reading.

"If your eyes are aching from fire-light, from looking at the snow, from overwork, or other causes, a pair of colored glasses may be advised, to be used for awhile. Light blue or greyish blue is the best shade; but these glasses are likely to be abused, and usually are not to be worn except under medical advice. Almost all those persons who continue to wear colored glasses, having perhaps first received advice to wear them from medical men, would be better without them. Traveling vendors of spectacles are not to be trusted. Their wares are apt to be recommended as ignorantly and indiscriminately as in the times of the "Vicar of Wakefield."

"If you have to hold the pages of *Harper's Magazine* nearer than fifteen inches in order to read it easily, it is probable that you are quite near-sighted. If you have to hold it two or three feet away before you see easily, you are probably far-sighted. In either case, it is very desirable to consult a physician before getting a pair of glasses, for a *misfit* may permanently injure your eyes.

"Never play tricks with the eyes, as squinting or rolling them.

"The eyes are often troublesome when the stomach is out of order.

"Avoid reading or sewing by twilight, or when debilitated by recent illness, especially fever.

"Every seamstress ought to have a cutting-out table to place her work on such a plane, with reference to the line of vision, as to make it possible to exercise a close scrutiny without bending the head or the figure much forward.

"Usually, except for aged persons or chronic invalids, the Winter temperature in work-rooms ought not to exceed sixty degrees or sixty-five degrees. To sit with impunity in a room at a lower temperature, some added clothing will be necessary. The feet of a student or seamstress should be kept comfortably warm while tasks are being done. Slippers are bad. In Winter the temperature of the lower part of the room is apt to be ten degrees or fifteen degrees lower than that of the upper.

"It is indispensable, in all forms of labor requiring the exercise of vision on minute objects, that the worker should rise from his task now and then, take a few deep inspirations with closed mouth, stretch the frame out into the most erect posture, throw the arms backward and forward, and if possible, step to a window or into the open air, if only for a moment. Two desks or tables in a room are valuable for a student—one to stand at, the other to sit at."

SCHOOL ARCHITECTURE.

The paper on this subject, written by Dr. Lincoln, is of the greatest importance to all who have any connection whatever with the building

and furnishing of school houses. The paper, as will be seen, is confined to the sanitary requirements of school buildings. The reason is, I presume, that after a careful examination of the school houses in Philadelphia, Dr. Lincoln found their condition to be as follows:

"First—That not a single school house had ventilating arrangements of the slightest use, except one new building, and even the apparatus of that building was wholly insufficient.

"Second—That in consequence of such deficient ventilation, particularly in cold weather, not only do the children and teachers become languid and unfit for study, but their lives are greatly jeopardized from the inhalation and reinhalation of a vitiated atmosphere.

"Third—That the only practicable method of securing a tolerable supply of pure air in the various rooms was by the uncomfortable and hazardous resource of open doors and windows.

"Fourth—That the condition of the privies of the various schools was, with few exceptions, simply abominable, and, notwithstanding the fact that observations were made in the Richmond school on one of the coldest days, a fearful odor from the privies pervaded the entire lower story of the buildings.

"Fifth—That owing to neglect in the proper care in placing children of different sizes at desks suitable to them, they often assume faulty postures, both in sitting and standing, and many likewise, from the same cause, become victims of defects of the visual organs.

"Sixth—That owing to poor ventilation, improper selection of desks, 'cramming' of studies, and ill-arranged school sessions, the rising generation does not promise to be a race of Spartan physique."

Perhaps we need not go to Philadelphia to find school houses to which the above remarks apply with equal force. Hence it will not be amiss to give the suggestions offered by Dr. Lincoln:

"First—Every school-building, old or new, whether heated by stoves or hot air furnaces, should be supplied with a ventilating apparatus, amply sufficient to render its atmosphere during school hours, especially in cold weather, comfortably pure, with all doors and windows closed.

"Second—The privies should be daily inspected by the janitors, and kept, particularly in warm weather, well deodorized by proper disinfectants, and what is called the "key system," should, as far as practicable, be introduced into the schools.

"Third—Desks, of at least three different heights, should be furnished to every large class-room, and special care should be exercised by the teachers in properly locating children of different stature. The custom of changing seats every two weeks, should cease, and the old-time way of having the children occupy their class rank only while at recitation should be revived.

"Fourth—Finally, all "cramming" systems should be abolished. The double daily school session should be replaced by a single session, with half hour recess, and the children should all be dismissed by two o'clock P. M., thus enabling them not only to avoid acquiring the peculiarly American habit of rapid dining, but, also, giving them opportunity for that complete relaxation of body and mind, so necessary to the healthful development of all young people."

These preliminary considerations will illustrate and add force to the

doctor's remarks on the sanitary requirements of school buildings, which I now give:

"SANITARY REQUIREMENTS OF SCHOOL-BUILDINGS.

"1. *Yard*—Should be placed by preference towards the sides where other buildings are standing or may hereafter be erected, rather than towards the street.

"Should contain at least thirty-two square feet of surface for each scholar, in order to serve as play-ground.

"Should be situated so high as never to overflow with water.

"Should be paved so as to be quickly dried after rain.

"Should be fenced, in certain cases (in order to shield from the passing gaze) towards all thoroughfares and alleys.

"2. *Site*—Elevated rather than low. Dampness of soil should condemn any site. The sun should have free access to the house on three sides at least. Many trees near the house are to be avoided, except in quite warm climates. Should not be near factories, railroads, etc.

"3. *Cellar*—Must be drained dry. A cellar, or else an air-space of two feet, must extend under the *entire* lower floor of the house, except in situations where the soil is very dry.

"4. *Basement*—The ceiling of the basement must be *at least* six feet above the ground. The height of such rooms should not be less than ten feet, and it must be thoroughly lighted. Basements, of which any portion is underground, should not be used for school-work of any description except gymnastics; and the latter are to be assigned by preference to a loftier room, above ground, when this is possible. Basements may serve for space for clothes-closets if thought fit.

"5. *Entries*—Should be always warmed and ventilated. Lighted sufficiently from out-of-doors.

"6. *Stairs*—Must be fire-proof, as also the walls inclosing them.

"Straight, never spiral. Height of steps four and one half to five inches (?), and breadth proportionally considerable. Breadth of staircase at least six feet in large schools; it must have no *well*. Not more than two runs in a stair.

"7. *Fire escape*—To be provided for every school-house of three stories.

"8. *Hall*—A large hall for assembling the whole school at once is a desirable feature, and if included in the plan it should have a floor-space in feet equal to the whole number of scholars multiplied by six (for younger scholars) or seven (for older), and should be not less than fourteen feet high. The ventilating arrangements for such a hall must be such that one thousand cubic feet of air per hour *can* be taken out for every one of the scholars as aforesaid. (This proviso implies the occasional use of the hall for public exhibitions (?), etc.) Such a hall may be suitably employed for singing, and for a gymnasium.

"9. *Gymnasium*—May be built, if thought proper, as a separate structure. If so, a covered and inclosed way must connect it with the school-house.

"10. *Rooms.*—Those for study ("study-rooms") must contain a floor space of at least fifteen square feet per scholar in primary schools, and twenty square feet in schools for children over eleven years of age. They must have a cubical capacity of at least two hundred and two hundred and fifty cubic feet per caput for these two classes of scholars respectively, or a height of say fourteen feet. When a portion of the scholars is expected to be constantly absent from the study-room for recitation, the requirements as to capacity for the study-room may be diminished; but rooms for recitation only, require no more than two thirds of the floor space per scholar above described, the height remaining the same, say fourteen feet. Each room, whether for study, recitation, or the general hall, must open into the entry by a door, and by a window eighteen inches high over the door. The walls of rooms are to be of a light neutral tint, colored, but never papered. Blackboards never placed on the side of room where windows are. Any columns required in the room must be of iron, in order to avoid darkening the room.

"11. *Windows*—Must never be in front of the pupils. They must contain a total of at least thirty square inches *glass* (excluding sash) for every square foot of floor surface in the room. The lower sill should be at least three and a half or four feet above the floor, and the upper should be within a foot, or less, of the ceiling. Arched and gothic tops are *inadmissible*. Windows not opening into the outer air directly are not to be considered as such in fulfilling the above requirements.

"12. *Closets*—Must be provided for the clothes, boots or shoes, and umbrellas of scholars. They must be so large that each one's garment can hang free, and have plenty of room to dry. They are to be warmed, lighted, and ventilated; but the warming and ventilation may be effected by securing a considerable draught of air from the entry or room into which they open, as the air in these places is presumably pure at the opening of school.

"13. *Water closets, etc.*—Separated for the two sexes. Screens when out-of-doors; in this case, to be also connected with the main building by a covered way, dry, clean, and ventilated. Those indoors, to be lighted and warmed, and ventilated by an outward draught of air. For girls, sufficient accommodation must be provided indoors; and if the house is three stories high, a third of the girls' closets are to be placed on the third story. Should never be placed under any school-room.

"14. *Drains*—Should be protected from rats, and precautions taken against the danger of fouling the drinking water.

"15. *Ventilation*—Must furnish the means of renewing the air of study-rooms and recitation-rooms, and gymnasia and singing rooms, at the rate of five hundred cubic feet per hour for each one of the average number of inmates intended for such rooms. For entries, one third of this ventilation is sufficient. In water-closets and clothes closets the current must always set *in*, never outwards into any entry or room. They cannot be safely ventilated by windows, as rain or snow might enter during the school session when the doors are closed. For water-closets, a double-door, with interspace of three feet, is good, the interspace to be kept well ventilated.

"The method of exhaustion by shaft of air-tubes is recommended, for large buildings especially.

"16. *Heating*—If by stoves or radiators exclusively, there should be also a proper system of ventilation added. In large schools, it is best to provide a single source of heat for all the building.

"*Miscellaneous*—Two stories are better than three or more. The main facade should not be to the south; it is best when the corners of the house are set to the four cardinal points of the compass. The north side is a suitable place for stairways, library, gymnasium, closets, and

any rooms for transient use; the front entrance may be placed on the north. The roof must not extend out so as to cut off light from the windows.

GYMNASTICS FOR SCHOOLS.

This subject was discussed by Dr. S. S. Putnam. The Secretary gives the following synopsis of the paper:

"Dr. S. S. Putnam divided his subject into three inquiries:

"First—In what way, and to what extent, may gymnastic training be made useful in the education of school children?

"Second—What means of securing it have been adopted, and with what results?

"Third—What means will be likely to insure the best results in our schools?"

"As to the first matter, Dr. Putnam suggested that gymnastic training could not fail to be of use in regard to training children who were not naturally strong, and therefore not inclined to take part in outdoor sports, which are of course, beneficial to the healthy and vigorous among our children. The benefits resulting from systematic gymnastic training are, too, decidedly different from those accruing from ordinary outdoor sports. The former scientifically trains special groups of muscles and confers special benefits upon the bodily system. Skilled instructors are, of course, required, and Dr. Putnam maintained that the result of such training was to promote general health, and to bestow special accomplishments.

"It is not necessary that very great muscular power should be developed, as that is not necessarily conducive to good health, nor does it always accompany it. One way in which school children may be greatly benefited is by helping them perfect the process of respiration. This was demonstrated by the work done by Prof. Monroe with the children of the Boston schools. Good breathing is by no means common, and the singing teacher has always much to accomplish in this respect. Instruction in this regard may not only give vastly increased power to healthy persons, but it may save many who are affected by lung disorders from early deaths. Dr. Putnam thought Professor Monroe's little book the best treatise upon this subject, while most German and French works on gymnastics, are very deficient in this respect. For the exercise recommended by Professor Monroe, no apparatus is required or special costumes, and for walking and running, a large empty room is all that is needed.

"Proper physical instruction in our schools would also relate to the sitting of the scholars, to proper methods of studying or of mental application, to proper means of ventilation, etc. It is a notorious fact, that many cases of injury to the spinal column arise from improper postures while sitting. Among seven hundred and thirty-one pupils at Neufchatel, sixty-two cases of this sort were observed among three hundred and fifty boys, and one hundred and fifty six cases among three hundred and eighty-one girls. The curvature of the spine occasioned was mostly to the right; caused, no doubt, largely by writing at unsuitable desks. The excess among girls is due, no doubt, very much to the fact that they take less active exercise, and are much less robust, as a rule. Herr Raag, of Berlin, says that he has found gymnastics very useful in preventing these spinal curvatures. With practical benefits

resulting from these exercises, the lectures on hygiene, etc., will have much greater force than otherwise.

"For proper school gymnastics, it is only requisite that there should be space enough about the desks to enable the pupil to advance one step, and to swing the arms freely. A large hall, with a few desirable pieces of apparatus, is all that is needed for further gymnastic exercise which is to give to the scholars special accomplishments in this matter. In Europe, halls are now considered absolutely necessary for the uses of scholars in the public schools.

"Another benefit, in Dr. Putnam's opinion, which results from gymnastic training in school life, is the sense of discipline and subordination which ensues, increasing the efficiency of the school and of the individual scholars. Military drill is advantageous in a similar way. Gymnastic training also assists the expressions of thought by giving another language more expressive in many respects than words. Thus Greek sculpture came somewhat, no doubt, from the fondness of that nation for physical exercise and training. The artists of Greece, even when not athletes themselves, lived among athletes. The common school may prepare the soil from which a taste for sculpture may spring. And Rev. Charles Kingsley heartily indorsed the idea of the advantages resulting from physical training for girls as well as boys.

"There are three recognized systems of gymnastics for school children: that of Friederich Zahn, born in Germany in seventeen hundred and seventy-eight, and were rather suited to make soldiers and athletes, and so hardly calculated for general use; that of the Swede, Ling, born in seventeen hundred and seventy-six, who used little apparatus; that of Spiess, born in South Germany in eighteen hundred and ten, who studied a drill of several persons, with various movements and sometimes including dances.

"In reference to the physical education of girls, gymnastics are not taught them in the primary schools of Holland, but are in the large cities. Apparatus is used only by the oldest scholars. Special schools of gymnastics are operated at various cities, to which girls are admitted.

"In Denmark and Sweden gymnastics are an obligatory study in all the public schools, and at Stockholm there is a central institute for the instruction of teachers in this art. A female pupil of this school has recently given some good instruction in Boston, and at the Girls' High School there. Much of the instruction is in sitting, walking, running, leaping, games, etc. In Prussia gymnastic culture is obligatory almost everywhere, and the official manual is a little book written by Angerstein. At Berlin three different varieties of diplomas as professors of gymnastics are conferred; of the central institute or municipal normal school; of the normal schools where gymnastics have been an obligatory study since eighteen hundred and fifty-four, and the ordinary instruction diploma. Very little, however, has been done for girls, except through private means. The needs of the army are considered supreme by the Government. It is probable, however, that changes in this direction will soon be made. It is the habit, too, both in Prussia and Holland, to furnish gymnastic instruction to the teachers in the schools, and to allow them to attend institutions where they can study gymnastics, free of expense, during the vacations. In other provinces of Germany more is done for the physical education of girls, and especially among the members of the German gymnastic confederation.

"In England there is no obligatory instruction in this branch, but it

is otherwise in France, Austria, and Switzerland. In this country something has been done in Boston, where a rule exists that twice each day a few minutes shall be devoted in each of the public schools to physical exercise. More was done by Professor Monroe, at Boston, than by any one else, and much has been done at Vassar College, at the Philadelphia Normal School, and at Amherst College. Dr. Dio Lewis, Dr. Mason, and others have also done much by their private teachings. Light gymnastics have been found particularly beneficial at Amherst.

"Teachers skilled in the work should certainly be employed in teaching gymnastics, and it would be desirable if all teachers could possess some knowledge of the subject. There should be exercises daily, once or twice for a few moments only, and two or three times each week more extended instruction should be given. Comparatively little fixed apparatus should be used, and light gymnastics should be the order of the day, chiefly. This course is recommended by the Belgian Commission.

"In conclusion, Dr. Putnam read some extracts from letters which he had received from teachers in different parts of the country. Their uniform testimony was to the effect that physical exercise should have a place in the daily programme of school life. These teachers believe that it would benefit both teachers and scholars. Some teachers, who have tried it, testify as to its positive value, and deplore the lack of interest generally felt in it by the masses of the people. Any schoolroom may soon be transformed into a gymnasium sufficiently well adapted for this purpose. Music is a great addition to the exercises, though not a necessity, and it is being much used. The great difficulty experienced is the lack of educated teachers. It is found, too, that this physical education tends directly to change and improve the dress of the girls. Tight lacing is necessarily abolished and more sensible systems of dressing are introduced than are usually employed. Several good books, treating on this subject of gymnastics, are mentioned by Dr. Putnam, and among them the manual of exercises used at Amherst, and prepared by Professor E. H. Barlow, the Captain of the gymnastic class of eighteen hundred and sixty-six."

The most important paper read before the Association, was, however, Dr. Lincoln's paper on the *Nervous System as Affected by School Life.* Detached abstracts would not do justice to the paper, and its importance will warrant me in giving it entire. I have therefore printed it in the Appendix, page 195*. "We have all heard," says Dr. Holland, "of the testimony of the Boston physicians against the system of forcing pursued by the public schools of that city, and of its tendency to produce nervous disease, and even, in some instances, insanity itself. The testimony is so strong and positive, and so unanimous, that it must be accepted as true." That this system of forcing and cramming has obtained a strong foothold in California, I need not point out. If our physicians would make a careful examination of the effects of our present system of instruction, it is to be feared that in many cities and towns we should find a similar state of things as in Boston. There must be a reform in our whole system, and school authorities should carefully weigh the suggestions of Dr. Lincoln's paper.

In order to bring school hygiene under State supervision, Dr. Lincoln submits a law for establishing the office of Medical Inspector of Schools. As in this State we have already not only a State Board of Health, but also health officers in several cities, it ought not to be difficult to make it the duty of some one of these officers to act as medic[al] inspector of the schools of the larger cities and towns, if not of th[e] whole State. Dr. Lincoln's law reads:

"First—He [the Medical Inspector] shall be appointed by the hea[d] of the Department of Public Instruction.

"Second—Term of office three years.

"Third—Must be a physician.

"Fourth—Is expected to devote his entire time to the duties of thi[s] office.

"Fifth—Salary three thousand dollars, payable quarterly, plus necessary expenses for clerical labor and travel.

"Sixth—He shall take cognizance of the interests of health among the teachers and children of the public schools.

"Seventh—He shall make sanitary investigations in respect to school houses and grounds, and to all circumstances connected with the management and instruction of schools which may appear to influence the health of scholars or teachers.

"Eighth—He shall make himself acquainted with the means employed in other States for preserving the health of the inmates of schools.

"Ninth—He shall seek to trace the origin and mode of extension of epidemic or other diseases among inmates of schools, and to point out measures for the arrest or prevention of such diseases.

"Tenth—He shall from time to time inform the Department of Public Instruction of the results of the aforesaid investigations, and shall suggest to the said department such modifications of the system of instruction and management existing in the schools of the State as, in his opinion, would conduce to the improvement of the health of teachers and scholars.

"Eleventh—He shall further, in the month of January of every year, present to the Department of Public Instruction a written report of his doings and investigations in the line of his duty as aforesaid, for the year ending with the thirty-first of December next preceding.

"Twelfth—He shall gather, and from time to time shall present to the department, such information in respect to the interests of the public schools as he may deem proper for diffusion among the people."

TECHNICAL AND INDUSTRIAL EDUCATION.

This subject, which has for several years so largely occupied the attention of educators and legislators in the Eastern States and Europe, has been prominently brought to the attention of the people of California during the last few years. England was awakened to the importance of the subject when, as Professor Tyndall states, the General Exhibition of eighteen hundred and fifty-one, and the Universal Exposition of Industry in Paris in eighteen hundred and sixty-seven, showed that England was outstripped in the arts of both peace and war by the Continental nations, in virtue of their better education. Eastern statesmen are also already alarmed that their manufactures are suffering for want of better education in their artisans. Massachusetts has already taken the initiatory steps by the instituting of a State system of indus-

trial art education. It is well, therefore, that California should take time by the forelock, and taught by the experience of older communities, rather than by dire necessity, engraft "technical and industrial education" upon its educational system, while that system admits of such grafting without endangering its whole existence. The system is still young enough to be trained in the direction which the wants of our present age demand.

THE NEED OF INDUSTRIAL AND TECHNICAL EDUCATION.

The necessity of making industrial and technical education a part of our educational system is, at present, not so urgently felt in this State as in older and more thickly populated communities. It will be, nevertheless, instructive to us to see how this necessity for industrial and technical education has made itself felt in England and in the Eastern United States. Dr. Mill describes the manner of having this necessity bitterly but profitably brought home to the English people, as follows:

"The Great Exhibition of eighteen hundred and fifty-one, and those which have been subsequently held, have given a rude shock to our insular pride and self-complacency by showing us that our former excellence in numerous branches of manufacturing industry has been lost, and, as a natural consequence, that we are beaten in many of the open markets of the world, not in one only, but in many, of the great staple articles of commerce. We had been content to remain in such perfect ignorance of what the great civilized nations of Europe were doing, and the thing grew so gradually and imperceptibly upon us, that we rubbed our eyes in wonder on awakening from a pleasant slumber to find ourselves beaten. But beaten we were, and that disgracefully too; and it only remained to ascertain the extent of our defeat and regain our lost position.

"The first thing that struck the observer of the productions of the industries of nations was, that we were rivaled in those articles which required artistic skill and intelligence in their production. In everything heavy and ponderous we held our own and held it bravely. No nation has yet rivaled us in the use of the steam hammer, in the construction of a bridge or railways, in linking continents together with telegraphic cables, or grappling and raising the broken fragments from the bottom of the deep ocean. When we approached the higher and more delicate branches of industry, however, we found ourselves beaten at almost every step. The silk weavers found that to get a piece of their goods dyed *black*, it had to be sent to the continent and brought back again, if the color was to be first-rate. Those engaged in the fancy leather trade made a similar discovery. The stuff manufacturers of Yorkshire saw themselves distanced by the weavers of France and Belgium, who, out of the same raw materials, produced a cheaper and better article; and in this manner some whole branches of manufacture, like the shawl trade of Leeds and the 'long ells' of Exeter, had been entirely absorbed by other nations. The lace makers of Nottingham saw that foreigners came, purchased their machines, took them home to their own countries, and by setting a more intelligent and artistically trained set of workmen over them, produced a class of articles with which it was impossible for our people to compete. The people of Birmingham ascertained that the hardware district was subject to a very severe, and in some cases ruinous, competition, and that they were being

beaten or undersold in more than one hundred articles, and those, too, of the most delicate and profitable description—those, indeed, which required a knowledge of chemistry in the amalgamation of the metals of which they are composed, and an artistic training to give them forms of taste and beauty. Our potters also found themselves not only subject to foreign rivalry; but to maintain their place at all in the struggle for existence, it was necessary to engage, at very high salaries, French and German artists and art-workmen, simply because Englishmen could not be found who were capable of executing the work. Neither is it in those occupations alone in which a knowledge of the fine arts is required that our young men find competitors. Formerly, foreign nations in search of shipwrights, engineers, and managers of large mercantile concerns came to England in search of foremen and managers; now, they turn rather to France and Germany, and find there a higher and better trained class of functionaries than it is possible for us to supply. Thus we found ourselves rivaled at every turn, and beaten in those very things in which we fondly believed that we excelled all the world.

"The inquiry naturally occurred—how has all this come about? Why is it that we, who imagined we could spin and weave for the whole world, find ourselves beaten in the use of the loom? The steam engine and electric telegraph had their birth with us, why have foreigners taken such a large share in the direction of the one and the manipulation of the other? Britain is the home of the ship. From her harbors the peaceful traders have gone out, and conquering navies have come in, for so many ages that their genesis is lost in the hazy dawn of history.

"The grand, noble old ocean, upon whose azure brow time writes no wrinkles, and which eternity itself can scarcely sere with age, is dear to the heart of every Englishman. Upon her beneficent bosom he travels around the world, plants his banner of freedom in every zone, and justly boasts that the sun never sets on his empire. Now, it is, I believe, true that Britannia still rules the waves, but it must be admitted that she has several times of late had a narrow escape from having it disputed in a very rude and uncomfortable manner; and even now, the French Commissioners of Public Schools, in their late report to the Emperor, claim an equality with, if not a superiority over us in certain important particulars in the construction and management of ships. Here, then, it will be seen that it is not simply in the smaller and more delicate branches of manufacture, but in the more substantial, and in those in which we fancied ourselves unrivaled, that the competition has stepped in, and on inquiring how all this had happened the reply was soon forthcoming—clear and lucid. The whole matter resolved itself into one point—education. Other nations were beating us in artistic and industrial productions, simply because they had been taught how to do it.

"It is due to our statesmen of every party to say that they are and have been greatly in advance of the people in the appreciation of the importance of this great work. Special commissioners were sent abroad to ascertain what really had been done by other nations. Reports were required from embassadors, ministers, and consuls in different countries, and thus, from various sources, accurate information was obtained. Beyond this, a searching inquiry was made into the state of education in England, and the result of all these investigations has been published in a number of those excellent, but much abused, because

little known, 'blue books,' and hence we have the whole subject before us, ripe for practical treatment.

"Briefly stated, then, the matter amounts to this. More than half a century ago, in eighteen hundred and fifteen, it occurred to some educationalist on the Continent to establish trade schools. One of the first of the kind ever attempted was that of Aury, established by Father Philip, for the purpose of teaching the people engaged in the coasting trade something of the construction and management of their ships, and also the rudiments of nautical astronomy and navigation. The instruction thus imparted was found to be of so much importance to the sailors, fishermen, and shipwrights, that other trades naturally followed the example set them, and hence 'apprentice schools' grew up in most of the large towns in France. It was soon discovered that drawing and mathematics lay at the very base of any successful course of mechanical instruction, and that those acquirements were available, and were, indeed, indispensable, to the prosecution of almost every art and trade. The 'machine' and 'weaving schools' soon followed in the wake of the 'ship schools,' and not long after 'stone schools' were established amongst the quarrymen of Volvic. Sometimes the enlightened enterprise of some manufacturer, or the foresight and penetration of a great educator, founded the institution; at others, necessity may be said to have been the parent of invention. This was notably the case with the weaving schools of Belgium. A few years ago some districts of that country were so impoverished as to be absolutely the most pauperized in Europe; and this state of things had been brought about by the people adhering to their old method of weaving and producing articles no longer equal to those of the same description made in other countries. Almost in despair, a commission of inquiry was appointed to investigate the cause of the decay of their ancient trade. Perceiving the error into which they had fallen, the commissioners proceeded to England, procured improved looms, engaged the best teachers of the improved art of weaving that could be hired, and founded weaving schools, which soon produced pupils who rivaled the English workmen in their textile productions. As a natural consequence, their trade has regained its ancient prosperity, and pauperism has been almost exterminated from the district. In this way, almost unknown and quite unregarded, those industrial schools grew up on the Continent; and it was only when we saw their productions in the International Exhibitions, and found them pushing our own out of the markets of the world, that the thing was forced on our notice as a matter which could be no longer ignored. You have all seen, and frequently admired, those beautiful little Geneva watches, now so commonly worn by ladies in this country. Now, Englishmen can make good watches; and if you want a chronometer worth a hundred guineas, or a watch worth forty or fifty, Coventry and Clerkenwell can supply an article which will hold its own against the whole world. But very few people can afford a good English watch, and if they could they are too heavy and cumbersome for ladies. If, then, you ask me why it is that the people of Switzerland have the monopoly of the market in supplying those beautiful little pocket companions, to which many of the fair sex are so partial, the reply is ready: They have an excellent school of horology in Neufchâtel—we have none in England; the whole secret lies there."

THE NEED OF INDUSTRIAL AND TECHNICAL EDUCATION IN AMERICA.

In the Report of the United States Commissioner of Education, for eighteen hundred and seventy-one, is published a letter from Louis J. Hinton, a young English mechanic resident in New York City, which, as the Commissioner remarks, "will be read with interest, as containing the expression of a practical, intelligent, and trained artisan, who has seen in Europe and the United States the advantages of that broader educational training, for which he so strongly pleads, as a necessity alike to American labor and capital." I quote as follows:

"Since arriving in this country and mingling among its mechanics, I have anxiously sought to find out wherein consists the difference between the skilled workers of America and those of Europe. Puzzled at the outset, by noting, in more than one case, newly-arrived artisans, whom I knew to have been counted in the old home as first-class workmen, failing to satisfy those who first employed them here, I afterwards saw the same men answer very well, when they had adapted themselves to the American system of work. The inquiry will naturally be, what is the difference between the systems of English workmen and American? So far as my observation extends, I should say that in England, as a rule, the first condition of work is that it should be done well; the second, that it should be done quickly. *Here*, the first condition is, that it be done quickly, the quality being of secondary importance. Employers encourage the fast workman, before the slower and better artisan—the man who takes pride in his work—by this course educating their employés to sacrifice everything for speed. That this is a system that will not answer in the future, however well it may have done in the past, is beginning to be shown by the ease first-class European workmen experience, when they come here and prove their skill, in getting employment at high wages in the many new trades springing up within our midst—trades that require skilled manipulation and previous training—while many native workmen have to be contented with the rougher work, not because they are not as clever, or in their natures as adaptable, as the skilled immigrant, for in fact they are more so, but because they *lack* just the higher technical training the new comers have had. Let me draw an illustration from one of the trades I am best acquainted with—stonecutting and carving.

"Here in New York are to be found the fastest stonecutters in the world; but are they the best? Hardly. Any one who has visited the Central Park must have viewed with delight the building known as 'the terrace.' On it are found the finest specimens of ornate stone cutting to be found in the country. Was this cut by native workmen? With perhaps a few exceptions, the answer would be, *no!* The beautiful carving was nearly all done by foreigners, who, if they had been trained here, would not have known how to cut anything outside the, to them, sing-song work of Corinthian leaves and capitals, the prescribed pattern that seems to be essential for the adornment (or disfigurement) of every house in this city (New York) that is built with a stone front to it. The workmen in the building trades afford a favorable and wide field for technical training. The carpenter, the plasterer, the stonecutter, the bricklayer, or the painter, all work out, every day they toil, prob-

lems in geometry, mathematics, and mechanics, to say nothing of architectural construction, which, perhaps, may be claimed to be a result of the three previously mentioned sciences. Be that as it may, it is very desirable that the mechanics who cover this country with habitations and public buildings should know something of the higher branches of their callings, without that knowledge being required to become highly scientific. Besides the building trades, there are many more established in our midst, or rapidly forming, as the resources of the country develop and the people increase in wealth and education, and their new wants call them into being, in which technical instruction is, or will be, absolutely needful; for instance, to workers in textile fabrics, cabinet and furniture makers, machinists, engineers, workers in leather, in bronze, the precious metals, gas-fixtures, etc. Take as an example the pottery trade. Is it not a disgrace to American manufacturers and workmen that European delf, china, and glass should supply so much of the demand for those household articles and ornaments? Surely there must be a clay here, if we had but the men who would know it when they saw it, convertible into good delf; and if there were but the same chances for instruction here as there now are in Europe, the man would be forthcoming who would not deem it beneath his powers to add to the beauty of even such common things as a cup or pitcher. There is really no good and substantial reason why American workmen should forever continue to imitate the patterns of European goods. Let them but have the same chances for instruction as their more favored rivals have had, and it will not be long before they add to the number of the few trades in which they have shown themselves to be the equals of the best workmen of any country.

"A very simple trade, commencing at first from the ingenuity, skill, and energy of, perhaps, one man, will oftentimes spread until thousands find employment and a livelihood at it. This is well known. I simply allude to it that I may cite a case in point—that of the manufacturing of children's toys. We have but to visit any extensive warehouse to discover how large a proportion of these delights of children are imported. Why should this continue? It could be stopped if the action of other Governments were copied. 'Some of the best modeled toys,' says *Cassel's Magazine*, 'in the world, come from Grünheinscher, in Saxony, where their modeling is attended to in the most artistic manner.' In Germany the Government educates its children in artistic construction. Hence the comparative cheapness with which we procure from that country those elegant toys that so delight Young America. The Germans are wise enough to use their best energies and talents in such simple trades as this, while dealing with the mightier, as of war and Statecraft; and, *painstaking as they are in small and great things*, it is no wonder they reap success. That trades may be drawn away, through the want and neglect of technical training, was shown, somewhat to the chagrin of English manufacturers, by the contents of the last great Paris Industrial Exhibition. It was there seen that, in many branches of industry in which Englishmen had long been accustomed to consider their country unapproachable, they were equalled, if not surpassed, by German, French, and Belgian manufactures, and that, in many of the lighter businesses requiring taste and high skill, they were 'nowhere' beside their Continental rivals. The change had been generally wrought within ten years. Naturally, they sought to learn the reason for this state of things, and found the chief to be that the French, German, and Belgian Governments had striven, with great success, to give to their

artisans such a thorough technical training that the artisans of those countries were able to put their individuality into their work; that is, highly-skilled workmen were able to turn out highly-finished work, so that when the buyers of the world wanted good articles, they knew they could get them of such or such a Parisian or Brussels firm. The revolution—for such the Paris Exposition proved to be—was not thrown away upon the English people. It was generally conceded, after a lengthy discussion, that, though the workmen of the past have been able to get along by sheer industry, for the future their powers must be added to; that, instead of a few men of an extensive trade being first-class, the whole trade must be lifted up to their plane. This could only be done by an improved system of technical education. What was found to be needful in England would prove of great use here; nay, the need for improvement is even greater *here* than there.

"The question will be naturally asked, What is meant by the term 'technical education for artisans?' It is not always easy to find a definition for phrases in common use, generally understood in a vague way, but thoroughly comprehended only by a few experts. The writer thinks he will not be far wrong if he defines what is meant by the term in England, by illustration, as follows: A bricklayer should not only know how to lay a brick, but why he lays it—not so simple a thing as it may at first appear; that an engineer should be able to tell when his machine is safe, as well as to be able to run it; that a cabinet maker should know something about the principles of art, as well as to fit and screw pieces of wood together; that a miner should have some acquaintance with geology and know more about mines than the simple fact of how to wield a pick in them; that he should be able to tell when a mine is safe, and when it is not so, thus avoiding, if possible, repetitions of the Avondale disaster. Surely this is nearly, if not quite, practicable. Artisans' technical education would require that painters should know how to harmonize the colors they so prodigally spread upon our habitations and public edifices; that the dyer should know something of the properties of the chemicals used in his business, besides their mere names, and so on through the list of the trades.

"In France, Switzerland, and most of Germany, the education of artisans commences when they are boys at school. It is surprising how much can be taught to boys before they are sent out into the world to learn a trade that will serve in making what they will be shown easy of comprehension to them. In England, in very many schools, they now teach free-hand drawing, once or twice a week, to the children attending them. Here I must record my earnest conviction that it is as absolutely necessary to teach boys who have, in after-life, to get their livelihood by skilled labor, free-hand drawing; although it be but the simple rudiments of that art, to me it seems as necessary as that they should know how to write, it being as easy to teach one as the other. The very fact that nearly all can be taught to write, proves that they can also be taught how to draw, writing being really, after all, but a species of drawing. Then free-hand drawing is a splendid method of training the hand and eye into perceptions of size, order, and proportion. If boys are taught (and girls, also,) how to draw, even but a little, they become apt to learn many things pertaining to the business of their after-life that, without such knowledge, would be as a scaled book to them. Besides, what is of great importance, the time of journeyman and foreman, who have to teach the apprentice, is saved. This the writer has proved by personal experience. He would rather teach half a dozen

boys how to cut and carve stone, if they had had even this slight preliminary training, that can be so easily imparted at the common schools, than he would show one who did not know how to wield a pencil.

"If we proceed to the journeyman, we shall find that having some knowledge of free-hand drawing, architectural and mechanical draughting becomes easy of comprehension. The economizing of the time of employés and men holds good here; half their time and care would be saved if the men under them only had some technical knowledge, beside a saving in material oftentimes spoiled by the mistakes made through imperfectly understood instructions, or ignorance of aught besides the simplest work.

"The leaders of our industries would have less care, more time to study out the improvements, and find new fields for their energies. The boy who had had his mind prepared, his eye and hand trained, by even the simplest lessons of the common drawing school, would, as a rule, be eager to learn more. It is just here that a system of good night or half time schools would prove of great practical utility, coupled with some general system of schools of art, such as have been established in England in connection with the South Kensington Museum, with branches established in every town of any importance, and having avenues open for the exceptionally talented pupils to travel upward toward the central school of art, where they might receive the very highest training that could be given them. Museums and galleries of industry and art are also of surpassing importance, as silent but patient instructors. America is shamefully behind in the matter of having public museums, considering the position she holds among the nations of the earth. It is only surprising that her people should have been able to do as well as they have done. Their success must be ascribed to that indomitable energy, characteristic of Americans, rather than to any aid given them by the National or State Governments, in whose hands, by right, the power rests, if the will be there, to see that their people have every advantage afforded by other Governments to their own people in the training that goes before all work. The writer devoutly hopes this letting alone an important need of the enrichers of the country will soon be changed. It must see that it is but poor economy to stop at only the frame-work, when paying for or preparing for the education of the people.

"With facilities for instruction freely open to all, there will be no lack of eager pupils. This is shown by the success of the noble institutions given to this city by Peter Cooper, and by the results of the act of Mr. Whitworth, in England, in founding scholarships open to every working man who could win them by his abilities. The example of these two gentlemen is worthy of the earnest consideration of the swarming crop of millionaires America is producing. Enriched by labor, they cannot do a more graceful thing than to help labor to further help itself."

THE REMEDY PROPOSED IN ENGLAND.

The revelation made to the English Government and people, that the British manufacturers were losing ground from the lack of proper education, claimed the attention of Parliament; and, accordingly, in March, eighteen hundred and sixty-eight, a select committee of nineteen was appointed to inquire into the provisions for giving instructions in theoretical and applied science to the industrial classes. The committee continued in session for over three months, sending for persons and papers

from all parts of the kingdom. From the minutes of the evidence procured, which fill nearly five hundred double column folio pages, I have only space to make the following extracts:

"The industrial system of the present age is based on the substitution of mechanical for animal power; its development is due in this country to its stores of coal and metallic ores, to our geographical position and temperate climate, and to the unrivaled energy of our population. The acquisition of scientific knowledge has been shown, by the witnesses, to be only one of the elements of an industrial education and of industrial progress. Nearly every witness speaks of the extraordinarily rapid progress of continental nations in manufactures, and attributes that rapidity, not to only the model workshops which are met with in some foreign countries, and are but an indifferent substitute for our own great factories, and for those which are rising up in every part of the continent, but, besides other causes, to the scientific training of the proprietors and managers in France, Switzerland, Belgium, and Germany, and to the elementary instruction which is universal among the working population of Switzerland and Germany."

The more important conclusions of the report are:

"1. That with a view to enable the working class to benefit by scientific instruction, it is of the utmost importance that efficient elementary instruction should be within the reach of every child.

"2. That unless regular attendance of the children for a sufficient period can be obtained, little can be done in the way of their scientific instruction.

"3. That elementary instruction in DRAWING, in physical geography, and in the phenomena of nature, should be given in elementary schools.

"4. That adult science classes, though of great use to artisans, to foremen, and to the smaller manufacturers, cannot provide all the scientific instruction which those should possess who are responsible for the conduct of important industrial undertakings. That all whose necessities do not oblige them to leave school before the age of fourteen, should receive instruction in the elements of science as part of their general education.

"5. That the reorganization of secondary instruction, and the introduction of a larger amount of scientific teaching into secondary schools, are urgently required, and ought to receive the immediate consideration of Parliament and of the country.

"6. That it is desirable that certain endowed schools should be selected in favorable situations for the purpose of being reconstituted as science schools, having in view the special requirements of the district; so that the children of every grade may be able to rise from the lowest to the highest school.

"7. That the managers of training colleges for the teachers of elementary schools, should give special attention to the instruction of those teachers in theoretical and applied science, where such instruction does not exist already."

Mr. J. Scott Russell, a member of the parliamentary committee mentioned above, and who has written an exhaustive treatise on the subject, comes to the conclusion that the technical schools required in England for the training of English workmen, are the following:

"1. *The Elementary Village School.*—A village school in an educated country is a very different thing from a village school in ill-educated England. Where we have one poor master or mistress, ill paid, poorly housed, perhaps also ill educated, educated Germany will have two or three schoolmasters to a single school, salaried by Government, trained and licensed from Government establishments for the education of schoolmasters—schoolmasters who have been taught not merely the things they have to teach, but also the principles of teaching and the practice of teaching, so that the teaching shall do the pupils most good and stay longest with them. They teach, in the true sense of the word.

"Now, in these village schools, with good trained masters, the time of the pupils is not wasted, as in ours, on mere reading, writing, and counting; they are taught, besides this, all the things that reading, writing, and counting are good for. Reading is useless if the pupil does not learn by it something useful, interesting, and worth reading; writing is useless if the pupil gets no notion into his head worth writing about, and if he has nothing to say worth saying; arithmetic is useless if the pupil is taught nothing to use his figures about; if he has no accurate knowledge given to him worth setting down in exact figures; if he knows nothing of the nature of the things which have to be put into figures. In good village schools, supplied with good schoolmasters, every child will be taught those knowledges that are put into reading, writing, and figures, in addition to the processes themselves of reading, writing, and counting. This, however, requires a reform in village schools, and with that reform a skilled craftsman would begin his useful knowledge-training in his village school.

"2. *The Upper Village School.*—In educated countries the upper village school is, on a small scale, what in a town would be a high school. It is a school for teaching elements of science to those villagers who are destined for skilled trades and occupations requiring intelligence and knowledge. The head teacher of an upper village school is a man of considerable education, and has generally one or two teachers under him. A child who has learned writing, reading, and counting, in the first school, may be transferred to the upper at the age of ten or eleven, if he be qualified; but if not, he should remain longer below.

"In the upper school the boy improves his hand by learning ornamental or elegant writing and fancy printing; he learns reading and repeating aloud in sounds that fit the sense and meaning; he fits his figures and reckoning to the facts and uses of life; he learns to draw from observation, to measure things about him; he should measure his school-room and draw it on paper—measure his village and draw it on paper; he learns what things weigh, what things cost, how much stuff each thing is made of, how strong or durable it is, what each thing is good for, how it is made, where it is found, or grown, or made; he learns the geography of his country, its population, its taxes, its government, its laws, its customs, the history of its people, the nature of its soil, its productions, its manufactures; he learns not only the names of all common flowers, plants, and trees, but their natures, their soils, their rearing, their uses; he learns something of his own body, the nature of food, the causes of health and of sickness; he is taught the uses of his own limbs in a fit and adroit, instead of an awkward and clumsy way; he is taught to sit, write, read, walk, run, leap, handle tools and instruments and weapons in a comely, useful, and dexterous way, instead of an unhealthy, ungainly, unseemingly way; he may also here learn some geometry, some chemistry, some physics, some geography and geology,

and a little French, or some language other than his own, enough to let him know how differently other folks may choose to express the same meaning. All this a boy may learn in an upper village school, provided, only, the schoolmaster knows what to teach, has properly prepared pupils, has fit apparatus of teaching, has sufficient help, and has the inevitable quality of loving his pupils and getting love from them.

"This upper village school is not a fancy school of my own imagining; it is such a school as I have seen successfully working in no very pretentious villages in foreign lands, where education is provided by wise governors and appreciated by an educated people.

"3. *The Third School*, for scholars from twelve to sixteen, cannot be a village school; it must be a town school. But such higher schools should be placed in towns, so distributed as to form centers, to which clever boys destined for skilled trades may be sent from the neighboring villages. It is, however, chiefly the inhabitants of these towns themselves whose children will be bred skilled craftsmen, as it is their wont to congregate (perhaps too much) in towns, such as those in which high schools should exist. The technical high school of each town, if well organized, will give the boy destined to a skilled trade or profession all the education that can best fit him for his skilled work. But the village boy who shows talent of a special kind should be sent out of his village to the town school, either at the cost of his parent, of his craft, or at the expense of the village community. Thus the *élite* of our country population would be trained to those occupations which their natural aptness would enable them to follow out with most advantage to the community.

"4. What I have said regarding apprenticeships being limited to short hours and supplemented by technical schooling, requires that there should be evening special schools for finishing the education of apprentices. In a village where there is an upper village school with good teachers, there is no difficulty in arranging that courses of science teaching, of drawing, modeling, sketching, and coloring, and courses of practical experimental lectures on physics, and chemistry, and mechanics, shall be given; only it is essential that Government appoint the teachers, pay them, and provide ample apparatus of teaching, and collections of examples, models, and books.

"5. In the four preceding ways, the young English workman may work his way up in knowledge and skill; but here he might have to stop but for the aids of which Mr. Whitworth has set the pattern. Exhibitions, by which skilled workmen trained in science can be helped on their way to eminence in their business, and a superior education will, I trust, soon become common in this country; but for this end, the technical colleges I have described, and the great technical university, must be established. When this machinery is in full operation, the poorest man's son, blessed with heaven-given talent, will find a school ready to receive him, to nourish his mind with useful knowledge, and to prepare him for a sphere of higher usefulness at each successive stage of his youthful career; and no man will be able to say that the learned and the governing classes of his country allowed his youth to pass in the hunger and thirst of uncared for ignorance and unchristian neglect.

"To summarize, the course of the education for skilled workmen is:

"1. The First Village School—seventh, eighth, ninth years.

"2. The Upper Village School—tenth, eleventh, twelfth years.

"3. The Upper Village Evening school—thirteenth, fourteenth, fif-

teenth years. These are finishing schools for those scholars who cannot proceed further.

"4. The Town Higher School—thirteenth, fourteenth, fifteenth years.

"5. The Town Evening Science School—sixteenth, seventeenth, eighteenth years. These are finishing schools for those scholars who cannot proceed further.

"6. The Technical College—sixteenth, seventeenth, eighteenth years. These are only for such scholars of distinguished talent as obtain exhibitions, and are thus enabled to educate themselves for foremen, managers, and masters.

"7. The Technical University. These are only for such scholars of distinguished talent as obtain exhibitions, and are thus enabled to educate themselves for foremen, managers, and masters."

TECHNICAL AND INDUSTRIAL EDUCATION FOR CALIFORNIA.

I need not point out that California, in common with the rest of the United States, needs schools similar to those described by Mr. J. Scott Russell. The first step towards the establishment of technical and industrial education must be a thorough reformation in our system of education. Every system of technical and industrial education must begin with the public school. I do not mean to say that the elementary principles of manual labor and the use of tools are to be taught in public schools; far from it. But I insist upon the necessity of rendering the talents of our youth directly useful to that society in which they are destined to pass their lives. In other words, "the public school should be the place to prepare thoroughly for the practical business of active life; and it fails to accomplish its work so far as it fails to secure this result."

Now it is acknowledged on all sides that the Germans have the model technical and industrial schools, as well as the model primary schools. A quotation from *Orcutt's Teachers' Manual* will show how the Germans lay the foundation for technical and industrial education already in the primary school, by adapting their teaching to the "practical business of active life." As will be seen from the extract, the teaching of arithmetic, grammar, composition, and spelling may be easily combined in school exercises. If my readers will bear in mind what Professor Young says concerning the teaching of language in the Baden schools (see *supra*, page 42), and take in connection with it the following practical exercise in composition, and compare them to our mode of teaching grammar, composition, and spelling, they will see the need of some radical change in our system of instruction, and will recognize which direction it must take, in order that our public schools may accomplish the work required of them. But to return to Mr. Orcutt's description of a German primary school:

"The subjects taught in this [German primary] school are religion, reading, writing, counting, mental arithmetic, writing to dictation, singing, grammar, repeating prose and poetry by heart, drawing, natural history, botany, and geography; not all at once, but gradually and thoroughly. The school opens at seven in the morning, and closes at eleven. One hour is devoted to religious and three hours to secular teaching, and then the school-day is over. The masters are always

fresh for work, and the children active, but not fatigued. There is no sham teaching, or dawdling over forms, in this school.

"Elementary teaching in Germany is made eminently practical, by applying the principles of each department studied to the business transactions of ordinary life. The teacher imagines, for instance, the purchase of some apples, and requires the children to calculate what will be the price of a certain quantity, and how much change they would get back for a dollar or half a dollar paid for them. The whole class are called into consultation, and much fun awakened by the incidents of the bargain. Writing is taught so as to include composition. No German boy or girl leaves the primary school who is not able to compose and write a respectable letter. But every teacher will be interested to know just how this German school is conducted to secure such practical results. I can in no way so well give this information as by quoting the description of an eye-witness who attended an hour's examination in one of these German primary schools:

"'The class being ranged, with slates and pencils in their hands, the master propounds the subject. 'Let me see,' he will say, 'to-day is market-day. You live, we will say, not here, but in the little house just beyond the village, three miles away. Mother sends you to market with something to sell, and for something to buy; but you are not to go home to-night, and so you want to write a letter telling her what you have done. Now then, begin. What shall we write down first?'—'I have sold three hens for ——' shouts a little fat white-haired fellow, who plainly is used to selling his mother's farm produce. 'Stop!' says the master; 'you are too fast. That's not the way to begin; we will come to that after.' Here several rise and ask to be heard. A little girl, with golden hair plaited down the back, shouts out, 'My dear mother!'—'No,' says the Herr; 'that's good; it will come later.' Another: 'To-day is Friday!'—'That's right; but there is more to add.' At last it is settled that the name of the place, and the day of the month, and perhaps the hour of the day, if need be, shall all be set down first, and at the right hand of the letter, before anything else is done. Having settled now what is first to be done, next comes the question how to do it, and the competition who shall do it best. The end of the room has huge blackboards, sponges, and chalk, and towels, with little long rows of steps for the little ones to climb up. The letter has first to be written out (in draft) on the blackboard, and corrected and settled finally before it is allowed to be written with ink on paper. Now, then, a child is called to write out (one on each board), at the right hand corner, the name of, say Rottenburg; the day, Friday; the date, Sept. 20, 1871. The arrangement of this gives rise to a variety of opinion and discussion. Shall 'Rottenburg' go down as two words or one? Shall 'burg' have a capital letter to commence with? Shall a stroke part the words, or shall the whole be written together? Shall Friday go below or on the line? Shall we write 20 Sept., or 20 September, or September 20? Shall we put 1871 below or on the line? Shall we begin near the top of the board, or lower, or more right or left? write on three lines, two lines, or one line? At last the test is settled, and the master asks the cleverest girl to write out the pattern agreed, dating at the right hand corner, with the proper margin all round; and this is now copied over by each on the slate as the right heading. 'My dear mother' i rightly placed at last the same way; and, preliminaries adjusted, the

real business of the day begins in earnest. 'My dear mother—I did not get into Rottenburg before the hand of the clock on the lower church told three quarters of eight,' and so forth. The letter being finished, revision and criticism begin. Each pupil changes slates with his or her neighbor, who has to pick flaws and find fault. The corrected slates are shown to the master, who gives the finishing touch. At last they all sit down to the desk, take pen and ink, mend their pens, rule their paper, and write out the letter fairly on the pages of their book, which is to form a standard reference for any letters of the sort they may want to write in their future life.

"'In all this proceeding there is nothing very new, perhaps, but is so admirably done that the spectator cannot help taking an interest in the process. Every item entered is made a matter of discussion. The price of fowls. How much a fat fowl should weigh. How much a lean one. A reasonable price. What food fattens fowls best. What sort of fowls they are, and how old. The price of cabbage, of carrots, of apples; their sorts, the quantity produced—everything to bring the school home to the life-wants, interest, and duties is done, the scholars themselves contributing each his mite to the store of information the letter contains. The expenses, too, of the day, the bargains, and the shops, are all discussed. After one such display as this, I went home, looking at the baskets in the market, at the donkey-carts lading for return home, at the buyers and sellers, and at the goods in the little shop windows, with more interest than ever I had in such things before. I felt that in this German school the children were training for the real duties of their lives.'"

Our current method of teaching grammar—"which is the statement of the forms and laws of speech"—is supplanting the study of language; and whilst our present method teaches the pupils "many interesting remarks about language, something of its history, inflections and caprice," it teaches but little of its essence and power, and its use. A revolution in our method of teaching language is a necessity. But we must also have a revolution in the teaching of the other studies, notably in those of arithmetic and geography.

"Children in our schools deal with numbers and study arithmetic every day in the week, and every week in the school year, for from six to ten years, yet it is very common to find pupils who have graduated from such training, who cannot tell how many yards of carpeting it would take to cover the parlor floor at home, or how much it would cost their father to plaster the walls of his house, at so much per square yard; who could not measure correctly a pile of boards in their yard; who could not calculate the dimensions of a bin which would hold a certain amount of coal; who could not take a practical note due at a certain time and reckon the interest; who could not tell how much it would cost them to obtain at a bank five thousand dollars for a definite time; who could not even make out a bill, write a note, draft, or check, nor tell how to indorse it; who could not, indeed, answer a score of other questions, with which the farmer, mechanic, or merchant, who went to school only six months in the year, and left school altogether at the age of twelve, or earlier, is perfectly familiar. All this is not the outgrowth of poor text-books, nor of poor theories of instruction, but it comes from an ignorance of methods on the part of those who

are expected to develop theories which have never been developed t them.

"It requires great skill, where books are used, to impress upon th minds of the pupils that they are doing the same work in school tha business men everywhere are doing out of school. A father says to hi boy, as he comes home from school at night, 'I have sold twenty fou bushels of corn, to be divided equally among twelve men; how man bushels shall I give to each?' The boy thinks, that is, looks wise, a he often does at school, is puzzled, and cannot tell. 'Why!' asks th father, 'have you not learned that yet?' 'O, yes,' the boy says, 'bu OUR *examples were all about potatoes.*' This may be an exaggeration, bu it illustrates the point.

"Until quite recently, and the practice is still in vogue, text-books i geography were arranged in a series of from three to five, placed in the hands of pupils at the age of eight or nine, and retained there for from four to six successive years, or until the pupil was ready for the high school. All this is, to my mind, radically wrong, and were I to fix the limit of text-book geography I would confine it to two years at most, and devote the time now worse than wasted, in '*broadening* and *strengthening*' other parts of the general system. Too much attention is given to mere description. Pupils memorize too much *in detail* about the climate, occupations, and productions of different localities and small divisions of the earth. Suppose our pupils can, at the end of a term or year, recite in concert like so many blackbirds, the localities of ten thousand towns, rivers, lakes, bays, gulfs, and mountains, the boundaries of all the States and countries, and the names of all the rulers thereof, etc., *ad nauseum*. Are they scholars? No; *they are stuffed parrots!*

"But we are beginning to live in the dawn of better days. Most of our geographical series are being reduced to two books, and when these are reduced to *one*, and that one to about two thirds its present size, it will, in the hands of good teachers, be exactly what we want. Let us see how geographies are used or abused.

"We will enter the school room; anxious faces are poring over and cramming the lesson of the day, oblivious to all but the jaw-breaking words that name the towns and rivers of China or some other portion of the globe. The bell strikes—a simultaneous Oh!—— goes through the room, and twenty pale and haggard children, with knitted brows and sighing hearts, rise, and casting a few last painful glances at some difficult sentence, gradually close their books, and with mournful tread and hanging heads approach the recitation seat; the lesson has been unusually difficult, and they hope for mercy. The teacher sits behind the desk with an open text-book before her, and with one eye on the class, as she asks the question, and two eyes on the book, as the question is answered, she proceeds to ascertain if the texts have been memorized.

"A few nervously organized budget-brained children, of good memories, recite *verbatim et literatim* the words they have learned. One boy knows the answer to his question, but he cannot pronounce the word. 'Spell it then,' says the teacher, and while the boy strains his memory to recall the position of the letters, the teacher keeps her eyes on the book to see if he spells it correctly. Some recite well, some poorly, some fail altogether. The time for the recitation has expired; another foot is measured off for another day; the class is dismissed, and one pale-faced little girl, with tender heart, but a poor memory, goes with tears in her eyes to her seat, sighing: 'O, if a good Providence had

made this world, and not put into it so many little islands, and bays, and gulfs, so many winding rivers and little towns, I should love to go to school and should be happy.' You tell me this is overdrawing, and I assert that it is a feeble picture of the experience of three schools out of five throughout the country to-day, and I challenge proofs to the contrary. And furthermore, I assert that it is far more the fault of the teacher than the book."—[*A. F. Nightingale.*

THE ELEMENTS OF NATURAL SCIENCES MUST BE TAUGHT.

In addition to a revolution in our current methods of teaching, the elements of the natural sciences must be taught. Professor C. F. Chandler, the eminent chemist of the Columbia College Mining Schools, says: "It is extremely important to introduce instruction in physical science in schools of all grades, no matter how low. The physical and natural sciences are taught in Germany, in the primary schools, with great success. * * * The great advantage of calling the attention of young children to the physical and natural sciences is due to the fact that their observing faculties, their inductive powers, and a faculty of correct discussion and minute and exact description, are thereby cultivated. In fact, the whole system of instruction in these branches is what we call 'object teaching,' the most effective method of imparting knowledge, and at the same time developing the various faculties, that has yet been invented."

"I am strongly of the opinion," says James D. Dana, "that children may begin the study of natural history to advantage as early as ten years of age. By that time they engage eagerly in collecting postage stamps, and that love of curiosities which they then exhibit might as well be utilized in ways more for their profit. If their attention were early directed by a judicious teacher toward minerals and plants, and an occasional out-door exercise taken, many would give up stamps for specimens in natural history. By two or three such exercises an interest is sure to be excited in stones of all kinds and colors, and new localities will be found by the children themselves, and new specimens brought in. The children will then gather up knowledge without effort. The result of such studies is somewhat like that from the opening of blind eyes; for the world becomes tenfold fuller of objects of interest and pleasure, and children make rapid growth in intellect through their improved powers of seeing and distinguishing, and their quickened habits of attention and thought. There is no doubt, too, that the early and general introduction of instruction in natural history would tend to multiply investigators, and give an impulse to scientific discovery."

I could multiply indefinitely the testimony to the value of the study of the elements of the physical and natural sciences. I shall conclude, however, with the testimony of Doctor Lyon Playfair and Agassiz. The former says: "Common sense, as well as the experience of other nations, indicates that an elementary knowledge of the principles of science and art involved in the occupations of the people should be introduced in primary schools, in order to make them a fitting preparation for secondary schools."

Agassiz says:

"What our colleges teach is mainly the traditional learning of the middle ages—nothing better. Harvard is not a university—only a tol-

erably well organized high school. The lower schools are, of cour following in the same track. If this learning were the best of its ki our condition would be better—but it is only the dregs of scholarsh 'and in saying this I wish to be understood to the letter.' What is (grammar, for example? It is no longer a living matter, but reduc to formulas from which all the living spirit has fled. What we need a knowledge of nature—of those forces of nature upon which all indu trial science is based, and which lies at the foundation of all our mc ern civilization. At present the phenomena of natural science are n taught in our common schools with any thoroughness; the reason wl clean water should be used rather than dirty water is not understo by the pupils—there is only a prejudice in its favor, and they take upon hearsay. They ought to know why it is better; they ought know something about the elements of the soil which they are to cu tivate and on which they live. The analysis of soils is no harder fo a child of twelve years than the construction of a sentence. Ele tricity, too—the telegraph by which we live every day—a child twelve could learn all about that, but he does not. What we want teachers that shall know these things with thorough knowledge, whic is not the case now. The normal schools do not educate teachers c the kind we want in this respect. They give instruction in botany geology, physiology, zoölogy, etc., but it is from text-books alone, an in the poorest possible manner. Our schools are the old treadmill o knowledge, while they might be made living sources of it; and thi applies to the schools of Massachusetts, as well as to those of th United States in general."

It is unfortunate, as I have already remarked above, that a study is to the parents and most teachers, represented only by a text-book; and when I speak of the introduction into our schools of the study of the elements of the physical and natural sciences, a vision of a multitude of text-books on physics, zoölogy, botany, mineralogy, etc., and a set of expensive apparatus, will rise up before most of my readers. It cannot be emphasized strongly enough that "nature" is the only text-book to be perused; that "there must be 'no learning lesson' from books;" that text-books must be nothing more than aids to the teacher; that the teacher must bring and keep "the child in sympathetic contact with nature." "Adam Stwin," in his readable articles in the *Christian Union*, has, in a happy manner, given numerous lessons on the method of teaching the elements of physical and natural sciences. I commend these articles to the attention of all teachers.

The apparatus absolutely necessary can be easily contrived by the teacher and the pupils themselves; a few dollars will buy the needed material.

If it be asked how we can introduce these additional studies when our schools are already overwhelmed with studies, the answer is by simplifying our current school work, especially in arithmetic, spelling, grammar, and geography. It is generally admitted that a great saving is possible in those studies. Again, geography and "object lessons," may be made the vehicle of a great deal of instruction in the natural sciences; and I am convinced that the introduction of those studies will not only simplify and rationalize our methods of instruction, but will also be a sovereign cure for "cramming," "parrot-drill," and other evils of our schools. The pupil will then "emerge from the common school possessed of the first requisite of the scientific man-power of exact

observation. The other qualities enunciated must be developed by the broader training of the high school, the technical school, and the college. But what efficiency and completeness their training would have if the facts of nature could have become a part of the child's mind before he submits to it!

"The average man thus furnished no longer walks through the world as in a vain show; every natural object attracts and interests him. The stimulus of his school training urges him to reading and investigation. The stone beneath his feet guides him to its history, nature, and purpose; the ants and the bees, the squirrels and the foxes moralize to him; the birds prophesy to him, while they pour their music into his delighted ear; the flowers teach him their impressive lessons of order in variety and fill his soul with their free gift of beauty. To him as well as to the philosopher poet,

——the meanest flower that blows can give
Thought that too often lies too deep for tears.

But, of all this pleasure within his reach, the average man, as far as the common school goes, is now deprived. Is this right?—*Prof. C. O. Thompson, Principal of the Worcester Free Institute of Industrial Science.*

DRAWING.

But *Drawing*, in its varied forms and application, is the foundation of all technical and industrial education; and it is therefore a study which it is essential to introduce into our common schools. The evidence in support of this claim of drawing as an essential branch of common-school education is voluminous and decisive. Those who are interested in this question, will find the evidence summarized in Stetson's *Technical Education* (Boston, James R. Osgood & Co., 1874), page 187, *et seq.*

Massachusetts, whose manufacturing interests are so vitally concerned in the question of technical and industrial education, has adopted a definite plan for introducing the study of drawing into the public schools. This plan did not confine itself, as in California, merely to the adding of the study of drawing to the common school curriculum; but as an initiatory step, the services of a competent person were secured to prepare a course of instruction and superintend its introduction into the normal schools and public schools of the State. Next a State Normal Art School was opened; the Legislature was induced to pass an Act making it obligatory upon every city and town having more than ten thousand inhabitants, to make provisions for giving free instruction in industrial or mechanical drawing to persons over fifteen years of age, either in day or evening schools, under the direction of the School Committee. This law is to be extended so as to include all towns of five thousand inhabitants and upwards.

The course of drawing at present prescribed in Massachusetts, will be found in the Appendix, page 125*; on page 138* of the Appendix a description of the workings of the plan is given. I am not convinced that the practicability of the plan will be demonstrated by experience; on the contrary, I believe the plan will have to be materially modified. Nevertheless, a study of the plan adopted by Massachusetts must prove suggestive.

I shall dwell no longer on this subject, closing it with the remark that since drawing must form the main feature in technical education designed for the great mass of the people, the initiatory step to the establishing of a system of technical and industrial education, must be a system of thorough instruction in drawing. But the study of drawing is also of importance to those who wish to acquire a liberal education in contradistinction to a technical education; and the introduction of the study of drawing into our public schools will broaden and improve our present common-school education.

TWO EUROPEAN TECHNICAL AND INDUSTRIAL SCHOOLS.

Two years ago, an attempt was made to induce the Legislature to pass an Act to authorize the Board of Education of San Francisco to establish and maintain a labor school. It will be interesting, therefore, to note how such labor schools are organized and conducted in Europe. Two English watchmakers thus describe the

MUNICIPAL SCHOOL OF THEORETICAL AND PRACTICAL WATCH-MANUFACTURE AT BESANÇON.

"This school is founded to secure the professional education of young people who intend devoting themselves to the art of watchmaking. The City of Besançon is the principal seat of the manufacture of watches in France. The manufactures of this city almost exclusively supply the French market, as, of three hundred and seventy-eight thousand four hundred and ninety-eight watches sold in France in eighteen hundred and sixty-five, Besançon supplied two hundred and ninety-six thousand and twelve, or nearly four fifths of the whole number.

"The school has for its object thoroughly to teach children the trade they intend to follow; to supply, in fact, the notorious deficiencies of an actual apprenticeship: and, if the apprentices, at the present time, are so ignorant of the practical part of their trade, they are much more so of the theoretical part. The object this school is now carrying out on a large scale, is to offer to young watchmakers an opportunity of constant comparison of the theory of watchmaking with the results at which they arrive practically.

"The regular time for this practical and theoretical course is three years; but it is desirable that the students whose aptitude and conduct is reported favorably of should prolong their stay at the school, in order to perfect themselves. The classes are held in a large building belonging to the city, the situation of which is all that could be desired. The classes are under the management of a director, who carefully sees that each branch of study is diligently followed out. The teaching is divided in the following manner:

"FIRST YEAR.—(Third Division.)

"*Practical Teaching.*—Filing, turning, hardening, and tempering metal, perfecting small tools for doing first halves of the ordinary sizes.

"*Theoretical Teaching.*—Revision of early education, arithmetic, mensuration, geography, mechanical drawing, general principles, making the more simple tools and machines employed in watchmaking.

"SECOND YEAR.—(Second Division.)

"*Practical Teaching.*—Doing first halves of various sizes, pivoting, and making the different parts of a cylinder escapement.

"*Theoretical Teaching.*—Studying style, geography, arithmetic, elementary geometry and its application, mechanical drawing, geometrical models, models of tools and machines used in watchmaking, designs of the different parts of a watch.

"THIRD YEAR.—(First Division.)

"*Practical Teaching.*—Constructing and planting the escapement, examining, regulating.

"*Theoretical Teaching.*—Course of mechanics, ideas of industrial chemistry, cosmography, commercial book-keeping and general geography, mechanical drawing, study of various cut wheels, models of escapements, and designing watch-movements for the model.

"The theoretical lectures are given in each division every day, from seven to nine o'clock in the morning, Thursday excepted.

"The work-hours are from nine o'clock in the morning till noon, and from half-past one till five.

"Drawing-lessons are given in each division on Mondays, Tuesdays, and Fridays, from five till seven o'clock in the evening.

"The course of commercial book-keeping and general geography for the first division is held every Wednesday, from five to seven in the evening.

"On Saturday, the director examines the pupils in the work of the week, so as to note step by step the progress made. In addition to the instruction given in the school, the pupils are taken from time to time to the different manufactories in the neighborhood, so that they may become familiarized with the various combinations and applications of machinery; and, also, to different workshops where the several parts of a watch are made. The knowledge which they thus acquire of the methods used in the actual process of manufacture, and which can only be gained in the workshops themselves, completes the education indispensable to a thorough knowledge of watchmaking.

"The school is visited each week by two members of the Board of Directors, composed of the most skilled men in the trade, who take note of the quality of the work done, as well as of the progress of the pupils. At the expiration of each scholastic year, the pupils are subjected to a general examination, at the end of which prizes are awarded to the most deserving pupils. The distribution of these prizes takes place in public, under the direction of the Mayor.

"This distribution is preceded and followed by a public exhibition of the productions of the manual labor of the students, and the designs executed by them, during the year. The vacation begins on the first of September, and continues during that month.

"The conditions of admission into the school are as follows:

"The school for watchmaking receives any young people, without distinction as to country or nationality. To be received into the schools, the pupils must be able to read and write fluently, and know the four rules in arithmetic. They are examined before a special jury before being admitted."

As a pattern technical college for the highest class of practical workmen, I give Mr. J. Scott Russell's description of the "Building Trades' College" at Stuttgardt, which is established for the education of a district where the building trades are sufficiently predominant to make that the leading feature of a technical college.

"The Building Trades' College at Stuttgardt is, I think, the best working man's school with which I am acquainted. It ranks next under their technical university, but it has been so successful that it has outgrown all the earlier anticipations of its magnitude and importance; and there is now preparing for it a building as large, and an organization nearly as extensive, as the technical university. I do not believe, therefore, that I can better contribute to the establishment of local practical colleges for high class master-workmen, than by giving a somewhat detailed account of this model working man's college.

I.—THE STUDENTS OF THE BUILDING TRADES' SCHOOL.

The purpose of this school is to give a systematic, organized, practical education to the following classes of technical men in their trades:

1. Future master builders of the trades of builders, stone-cutters, carpenters, and joiners.
2. Town surveyors, inspectors of buildings, officers of health and public security.
3. Engineers of drains and sewers, and mill owners.
4. Surveyors and measurers.
5. Workmen in all the following trades who may be desirous to qualify themselves to become masters, foremen, or leading men:

Plasterers, slaters, bricklayers, mechanics, millwrights, locksmiths;
Carpenters, glaziers, turners;
Painters, ornamental carvers, modelers, and molders;
Engravers, gold and silver workers;
Gardeners and farmers;
Draughtsmen.

II.—COURSES OF EDUCATION.

1. Building School.
2. Surveying and Measuring School.
3. Waterworks and Draining School.

III.—THE PROFESSORS.

It is to be remarked of this excellent college, that the teaching staff transcends all our English notions in eminence and strength.

In this workman's college there are no fewer than twenty professors, and these professors are not men of inferior position and humble social rank, but men of eminence and distinction. Imagine in London our having the courage to propose, or even to dream of taking our most distinguished architects, engineers, builders, and philosophers, and making them professors in a workman's college! Some one will say, perhaps, that in Jermyn street Museum we do something of the sort. I have only to say, with the highest respect for Jermyn street, that as a working man's college, no comparison can be instituted that is favorable to Jermyn street, excepting in the fact, that some of our most distinguished men have lectured there, and that some of the classes are known to be attended by workmen. That Jermyn street buildings and Jermyn street Museum might aptly form the nucleus of a great college for the building trades of London, I am perfectly willing

to admit, and it would indeed give me great pleasure to see it become, what the college in Stuttgardt is, a favorite resort of working men, filled day and night with teachers enthusiastic, and students zealous, industrious, and ambitious. I ought not to begin the list of eminent men who teach in Stuttgardt, without saying that Oberbaurath Egel, the first on the list, is the man to whose patriotism and enthusiasm the existence and maintenance of the school are mainly owing. He has done for it what Sir Henry Delabeche did for the school of Jermyn street. In regard to the other professors, I call particular attention to the fact, that the larger number of them are technical men, and not merely professors and teachers.

Principal.

Chief Architect of State..........................Von Egel.

Vice-Principal.

Professor..Häberle.

Teachers of Building Trades.

Chief Architect.......................................Von Egel.
Master Builder...Silber.
Master Builder...Stahl.
Architect..Beyer.
Architect..Wagner.
Architect..Riess.
Architect...Walter.
Master Workman.............................Baumgartner.

Teachers of Surveying and Mathematics.

Chief Surveyor...Wall.
Foreman Surveyor...................................Remmell.

Teachers in Mathematics and Physics.

Professor...Häberle.
Professor...W. Fischer.
Machine Builder.....................................Teichman.
Professor...Bopp.

Teachers in Drawing and Ornament.

Sculptor...Plock.
Architect..Grauth.

Teachers in Other Departments.

Doctor...Büchchele.
Doctor...Frauer.

Assistant Teachers.

Häuel, Dewzel, Andelfinger, Scherer, Fischer, Lochman, and three others.

IV.—CURRICULUM OF EDUCATION.

The curriculum consists of five divisions; the two first elementary, and the three last practical. Each division is also subdivided into two parallel divisions, and each division may be taken either as a Summer or a Winter course, so that students whose trades predominate in Summer or in Winter, can attend the school at the least sacrifice. The whole payment for a complete course in any one of these divisions is twenty shillings, but there are also many free scholars, and many pupils who have exhibitions, both from the State, from communities, and from private foundations. It need hardly be added, that nearly the entire cost of the maintenance of the school is provided by the public funds.

Course of Instruction in the College for the Building Trades.

FIRST CLASS.

Two Parallel Divisions.

Destined for such pupils as have only visited the National School, or who, having attended a higher school, are not quite up to the mark of the second class.

LANGUAGE OF THE COUNTRY.
Eight hours a week.
Dictation; reading, prose and poetry; explanations and preparations of the same; exercises; lectures.

FRENCH LANGUAGE.
Four hours a week.
Exercises in reading, and translation for beginners.

HISTORY AND GEOGRAPHY.
Four hours a week.
The principal events of ancient and modern times; physical and political geography.

CALIGRAPHY.
Six hours a week.
Perfection of handwriting; simple copies.

ARITHMETIC.
Six hours a week.
Vulgar and decimal fractions; simple and compound addition; interest and percentage; proportion.

ELEMENTARY GEOMETRY.
Six hours a week.
Plane geometry, up to trigonometry.

FREE-HAND DRAWING.
Six hours a week.
Simple lines and combinations; simple leaves and ornaments in outline.

GEOMETRICAL DRAWING.
Six hours a week.
Geometrical constructions; geometrical proportions and geometrical ornaments.

SECOND CLASS.

Two Parallel Divisions.

LANGUAGE OF THE COUNTRY.
Six hours a week.
Continuation of the subjects of the first class, with an increase in the exercises on style.

FRENCH LANGUAGE.
Two hours a week.
Practice in reading and translation for advanced pupils.

CALIGRAPHY.
Three hours a week.
Plan.

ALGEBRA.
Eight hours a week.
Literal calculus, powers, roots, and logarithms; equations of the first and second degrees.

GEOMETRY, AND THE GEOMETRY OF THE SOLID FORMS.
Eight hours a week.
Repetition with the pupils of the first class, and the completion of the remaining divisions of plane geometry; geometry of space with regard to representative geometry; calculation of cubical contents.

BUILDING PLANS.
Eight hours a week.
Simple foundations; projections and sections; plane projecting and curved decorations; simple buildings in antique and Gothic styles, after drawings with measurement and descriptions on the blackboard.

ORNAMENTAL DRAWING.
Six hours a week.
Simple ornaments in outline from copies and casts.

THIRD CLASS.

Three Parallel Divisions.

PHYSICS.
Six hours a week.
Balance and motion of solid, fluid, and gaseous bodies; the laws of heat; on the phenomena of sound, light, magnetism, electricity, and such parts of chemistry as concern building materials.

REPRESENTATIVE GEOMETRY.
Eight hours a week.
Descriptive geometry of the highest order, with immediate reference to its application to the purpose of architectural design and practical building construction.

TRIGONOMETRY.
Two hours a week.
The trigonometry of right-angle triangles.

PRACTICAL GEOMETRY.
Six hours a week.
On surveying, leveling, and map-making by means of planes, reflecting instruments, and levels.

PLAN DRAWING.
Six hours a week.
Complicated architectural details; windows, porticoes. Exercises in the adaptation of the simpler forms of buildings.

ORNAMENTAL DRAWING.
Six hours a week.
Principally drawings from casts in outline and shading on white and tinted paper, with pen, pencil and chalk.

BUILDING ART.
Five hours a week.
On decorative construction in stone for windows, cornices, doors, etc. Some of the drawings must be full size.

BUILDING CONSTRUCTION.
Five hours a week.
Constructions in stone, partition walls, windows, and roofs.

FOURTH CLASS.

Two Parallel Divisions.

MECHANICS.
Three hours a week. (One professor.)
Examination in the laws of gravity; application to beams, rafters, etc.; on stability; machinery, with regard to the uses of workmen.

APPLIED DESCRIPTIVE GEOMETRY.
Six hours a week. (Two professors.)
Pure descriptive geometry applied to stone carving, light and shade, and perspective. Drawings from copies.

ARCHITECTURAL DRAWING.
Six hours a week. (Four professors.)
Drawing of entire façades in outline; large drawings from small copies in strictly Renaissance style, preparatory to designing.

ORNAMENTAL DRAWING.
Four hours a week. (Two professors.)
Continuation of the instruction of Class III, with use of the paint brush.

ARCHITECTURE.
Two hours a week. (Two professors.)
Decorative forms of timber and woodwork. Lecture and practice in drawing.

BUILDING CONSTRUCTION.
Five hours a week. (Two professors.)
Timber supports, struts, and ties, roof frames, etc.

INSPECTION OF BUILDINGS.
Four hours a week. (Two professors.)
Instruction for overseers and inspectors of buildings; designs and other preparations for superintending the erection of a building; rules for the method of working, etc.

ON WARMING AND VENTILATION OF BUILDINGS.
Six hours a week. (Two professors.)
Properties and heating power of fuels; temperature of ignition, and necessary air for heating; draught of chimneys, calculations of their dimensions and construction; ranges and fireplaces, baking houses, etc.

On the Various Styles of Architecture.
Four hours a week. (Four professors.)
Short remarks on the commencement of architecture; account of the Roman and Greek styles in detail.
This department is specially illustrated by diagrams.

FIFTH CLASS—(Division A.)

Ornamental Modeling.
Four hours a week. (One professor.)
Modeling in plaster and clay, generally after their own drawings; plaster castings from clay models.

Building Construction.
Four hours a week. (One professor.)
Difficult wooden roofs, suspension roofs, etc.; various roofs, their advantages and disadvantages; scaffoldings, ceilings, and roofs with a partial and entire application of iron; carpenters' and glaziers' work.

Designs for Buildings.
Nine hours a week. (One professor.)
Designs for simple town and country houses; simple buildings on a limited or unlimited space; parsonages, farms, stables, small breweries, schools, and town halls. The designs are to be made in ground plans, sections, and elevations, and the façades shaded either with pen or pencil. There will be a competition during each half year, when a premium will be offered and the drawings publicly exhibited.

Architecture.
Four hours a week. (Two professors.)
Early Christian styles; Roman and Greek; Renaissance; lectures and drawings after special diagrams; excursions to see different buildings.

Construction of Roads and Bridges.
Four hours a week. (One professor.)
On drawing up contracts for materials and labor, and a detailed account of costs.

Agriculture.
Three hours a week. (One professor.)
Designs and contracts for laying out farms, with their buildings and outhouses and breweries.

Mathematics.
Four hours a week. (One professor.)
Repetition of elementary mathematics, with fresh exercises.

FIFTH CLASS—(Division B.)

Designs for Buildings.
Development of designs according to programmes for advanced pupils. Larger school houses and town halls; hospitals, poorhouses, hotels, breweries, etc.

SCHOOL OF SURVEYING AND MEASURING.

Geometrical Construction.
Two hours a week. (One professor.)
Solutions of geometrical problems; construction of algebraic expressions.

Application of Algebra to Geometry and Stereometry.
Six hours a week. (One professor.)
Solution of geometric and stereometric problems by means of calculus.

German Exercises.
Two hours a week. (One professor.)

SPECIAL CLASSES FOR GEOMETERS.

Descriptive Geometry.
Eight hours a week. (One professor.)
As in the third class of the Building School.

Physics.
Six hours a week. (One professor.)
As in the third class of the Building School.

Trigonometry.
Six hours a week. (One professor.)
Practical trigonometry and polygonometry; transformation of rectangular coördinates.

Plan Drawing.
Four hours a week. (One professor.)
Field and land planning and surveying.

Popular Building Construction and Building Drawing.
Eight hours a week. (One professor.)
Explanations of ordinary building construction with regard to the measurement of buildings; drawings of simple outlines of buildings.

Practical Geometry.
From 6th November to 15th March, six hours a week. From 16th March to 1st May, twenty-eight hours a week. (One professor.)
Lectures and practice; theory of instruments; surveying and dividing planes by cross staff and theodolite; distances and sections; surveying contour lines by the level; geographical, trigonometrical, and polygonometrical determination of points by measuring table and theodolite; errors and coördinate calculations; trigonometrical measurement of heights.

Mathematical Practice.
From 6th November to 15th March, twelve hours a week. From 16th March to 1st May, four hours a week. (One professor.)
Repetition of algebra, geometry, stereometry, and the solution of various problems by construction and calculus. Drawings with the necessary ground plans, sections, and façades. Lesser competition prizes for the pupils at the beginning and end of each course, and at Christmas. Public distribution of prizes.

Designs for Building Constructions.
Six hours a week. (One professor.)
Construction of designs from prescribed conditions; simple and complicated roofs, staircases, ceilings, etc. The drawings are to be on a large scale, and the most difficult portions given in great detail.

Repetition of Mathematics, Physics, and Mechanics.
Six hours a week. (One professor.)

Essays on Building Designs.
Two hours a week. (One professor.)

SCHOOL FOR DRAINING AND WATERWORKS ENGINEERS.

This branch is in course of formation.

MACHINE DRAWING.

Eight hours a week. (One professor.)

Drawings of wheels and toothed wheels; drawings of parts and wholes of machines.

THE KINDERGARTEN.

The opinion is gradually gaining ground that our common school education would be materially benefited, if not perfected, by the introduction of the kindergarten system. In eighteen hundred and seventy-two, the National Educational Association appointed a committee "to inquire into the form in which Froebel's principles of education may be most efficiently applied to the educational wants of this country." In eighteen hundred and seventy-three, the committee made a lengthy report, through Professor J. W. Dickinson, of Massachusetts, which I give in full. The report will show the meaning and scope of the kindergarten system, and its adaptability as a part of our public school system. In answer to many inquiries, I publish in the Appendix an illustrated article on the *Kindergarten Toys, and How to Use Them.* The illustrations of this article, as well as of the one immediately preceding it, are furnished by E. Steiger, to whom this country owes a great debt of gratitude for his unwearying attempts to introduce the kindergarten system, and to rationalize our present text-books.

The report of the committee of the National Educational Association reads:

"The immediate end of the kindergarten is to make children happy. It aims to accomplish this end by means of plays; such innocent plays as children of almost every age and race have practiced, and will always continue to practice while they are of the proper age to be proper subjects of kindergarten instruction. These plays are so manifold, that children will never be at a loss *what* to play, and they are so simple, yet so ingenious, as to develop all the powers of the human mind gradually and harmoniously.

"The objects used in these plays were devised by Froebel, the great German educator, who, in a life of seventy years of practical teaching and deep reflection on educational ideas, at last found a plan that, if properly applied, will result in a harmonious mental development.

"These objects are called gifts, and are numbered. The 'first' consists of a box containing six balls; a red, a yellow, a blue, an orange, a green, and a purple one, made of wool, and woven over with worsted. They may be suspended by a thread. The second 'gift' consists of a box containing a spherical body, a cubical, and a cylindrical one, each of which may also be suspended. These gifts may be used by the mother, with the infant yet on her lap, in quite a number of various exercises calculated to awaken and sharpen the senses. The exercises should be

accompanied with short simple songs, the words of which express in the simplest manner the idea of the exercise, while the melody deeply impresses the mind, and awakens the first moral feelings of the infant, and excites an interest in the object presented. In this way a feeling of gratitude is awakened, and a love of order, of rythm, and harmony. Froebel did not invent these exercises. He carefully studed the plays of many excellent mothers with their babes, copied and systematized them, for the benefit of all other mothers; with the caution, however, not to follow slavishly the *letter*, but the spirit of his directions. It was Froebel's idea that the world can be universally improved and a higher humanity produced, by the work of the mothers, through a perfect education of their sacred calling. He was one of the earliest and truest advocates of woman's equal rights, and had the most exalted idea of her capacity to teach, if the capacity be properly developed. When the children come to the kindergarten they are no longer infants, but can speak and act. Now the exercises must be altered, according to the peculiar wants of the child.

"The child is an active being, and whatever it really learns, it learns through its own activity; and it is really happy only while it is doing; while it is handling objects, *transforming* in playful exercise. Many thinking parents have harbored or expressed the thought that he who could make children play in a manner involving all the advantages of play, but so as not to destroy, not to disturb the order, quiet, and comfort of others, and not to contract vicious habits, would be among the greatest benefactors of his race. This is what Froebel proposes, and shows how to achieve, and he has invested an inexhaustible store of mature experience in devising means for the attainment of this end. If the means are to be effective, three conditions are necessary: First—There must be a collection of children, so that they may be prepared for their future social duties, and may be fully amused. Second—They must be under the guidance of such adults as combine with the necessary pedagogical abilities the capacity of motherly feelings and child-like temper; young women prepared by nature and by culture for the work. Third—The place of assemblage must be a combination of a school-room with a play-ground, cheerful, wholesome, roomy, adapted to all the plays and games, and provided with the toys and tools for play and work proposed, and with a garden plot. In these conditions you have the idea of a genuine kindergarten.

"In such a place, and under such influences, the active powers of the young child begin to exert themselves, free from the corrupting influences of ignorant or vicious servants, or the equally corrupting influences of the public streets. This first activity will leave its full impression upon the young minds that act, and give character to their whole future being. It is not proposed to curtail the liberty of the children nor render their minds uniform by a uniformity of employment; all that is proposed is to lead them to the best possible use and to a greater range of liberty, and to do this so as to render all constraint superfluous, and to develop every individual mind in its own way. It is the criterion of a genuine kindergarten that all its pupils are happy; more regular in attendance than those of any other school; that they discipline themselves without the slightest visible outward constraint; that they of themselves become zealous in invention; that they acquire a love for the study of objects, and the relations found in them and in

their qualities. It is not proposed to overstrain the physical and mental powers of the child by sending him to school at an early age; on the contrary, it is the intention to exempt him from every mental and bodily strain up to his full seventh year. He is not to be troubled with reading, writing, and ciphering until that time; but all his powers are to be developed in a pleasurable way, so as to secure rapid progress in these studies afterwards. The most competent medical men protest more earnestly from year to year against subjecting the pupil to the discipline of serious schooling before he has reached his seventh year. More than half a century ago, Froebel protested against it, as being the best means that could be invented to render the majority of students irrecoverably stupid. He thinks that before the seventh year of life, common school instruction cannot have a developing effect on the child's mind.

"The first gift mentioned reappears in the kindergarten at several stages. First, the colored balls are used for ball games of various kinds, to which, during the pleasant season, much time is devoted with the youngest children. They serve as charming and appropriate gymnastic exercises, especially as they are connected with song, and not carried on at command. The exercises call all parts of the body into exercise, and the little ones learn instinctively to fall into rythmical uniformity. At last the six colored balls are used in teaching object lessons on color. The second gift consists of a globe, cube, and cylinder, or more accurately, of a spherical body, a cubical body, and a cylindrical body. The occupation with them is carried on with the children in a sitting posture round low tables, at which from twelve to twenty children may find place. The little ones, slightly wearied with movement games, come easily to order for a short talk of the kindergartener with them.

"Their power of speech is now to be cultivated, and their minds trained to use the senses. They see, touch, and hear, what is to be seen, felt, and heard in the objects presented. They are lead to state in their own language what movements and qualities of objects they have perceived, and their imperfect expressions are corrected.

"At the first exercise they learn that the cube has six sides, while the globe has but one; that the cube has corners and edges, while the globe has none; that the globe rolls and is round, and the cube does not, and its sides are flat. At a later stage they learn that the cylinder rolls only in one direction, while the ball rolls in all directions; that the cylinder may stand firmly on two planes, the cube on six, and the two planes of a cylinder are equal to each other, and the six planes of the cube are equal to one another. At a later stage, they find on the cube eight corners, twelve edges of equal length, and that its planes are squares. Still later they find that the two flat sides of the cylinder are circles; and what the cone is; in what it differs from the globe and cylinder; what right angles are, and how many there are on each plane, and on the whole cube. The sound which these bodies produce in striking or rolling on the table, and impression they make on the touch, are perceived, named, and remembered. These exercises proceed gradually; unerring precision in knowledge and speech is to be sought for as the result. After the first acquaintance with the cube, the little company are set to playing with it. This is done by means of the 'third gift,' a cubical box containing a wooden cube cut once in every direction, so as to make eight small cubes or building blocks. The child is left to its own ingenuity in devising building-plans, but an occasional conversation of the teacher may suggest new tasks, throw light on the

properties of buildings, and invite the pupil to state what its own structures mean. This use of building-blocks for forms of life is followed by a second use, for forms of beauty; mosaic work, which produces stars, crosses, wreaths, and the like, when viewed from above. The teacher leads the child to produce a great variety of such beautiful forms, by suggesting a method; every new one must originate by a modification of the preceding one; one square at a time changing its place. Every block must be used, and no form destroyed. Finally she shows them how to unpack their toys, and how to pack them up again, and how to keep them always in the proper place and in proper order. The third use, that for forms of knowledge—has already been described.

"Every one of Froebel's gifts is put to these three uses—for forms of life, of beauty, of knowledge, and their use is to be accompanied by conversation.

"The 'fourth gift' is a box containing a cube cut, by one vertical and three horizontal cuts, into eight bricks. The 'fifth gift' presents a cube cut into thirty-nine blocks, of three different triangular forms. The 'sixth gift' presents thirty-six smaller bricks.

"The variety of structures possible with the increasing number and kind of blocks must keep pace with the mental capacity of the child using them. Thus the gifts mentioned present an almost countless variety of exercises that may keep the pupils amusingly employed for a part of their time during years, and develop their power of attention, skill of fingers, invention, comparison, sense of beauty, language, love of order, and their social virtue. Another series of boxes contain *colored tablets* which represent geometrical planes; the rhomb, the equilateral and rectangular, isosceles and scalene triangles.

"Beginning with the fifth year, they are used at several stages, for progressive exercises, and may profitably be used in school.

"The *interlacing* of *chips* may set in during the sixth year of the child's age. The wooden chips are ten inches long, one half inch wide, and just stiff enough to allow their connection into manifold forms of life, beauty, and knowledge.

"The laying of sticks may form an occupation as early as the third year, and may be continued for more artistic productions, in which a number of children may associate, until the seventh year. The sticks are frequently used for exercises in counting [and in mental arithmetic] by adding, subtracting, multiplying, and dividing numbers as high as thirty.

"The laying of circular and half-circular wires, twenty-four of the former and forty-eight of the latter, is most appropriate for forms of beauty, but may also be used for teaching properties of the circle.

"Drawing on square-ruled slates, or paper, may be begun, the former in the fourth, the latter in the sixth year. Drawing is a favorite occupation with all the children, and may be so conducted as to train the hand and eye, and cultivate the sense of beauty. *Peas-work* is a fascinating exercise, carried on with sticks of small size, or with wires, and with peas soaked in water for twelve hours and dried for one hour, when they are just soft enough to admit the wire, and hard enough to hold it in its place. With this simple material, all kinds of planes and geometrical bodies are represented, and skill of hand and measurement by sight may be acquired.

"Perforating and stitching paper require a thick needle fastened in a holder, and square-ruled paper laid over a thick layer of blotting paper. When the skill necessary to produce straight and curved lines is ac-

quired, simple lithographed pictures may be perforated. A thick kind of paper thus treated may be stitched over with colored worsted, and an endless variety of beautiful forms produced. At the latest stage the forms may be colored with the three ground-colors and their three simple mixtures.

"*Twining of strips of paper*, folded trebly, and six inches by eight long, three fourths inch wide, the ends of which are glued together, and the whole form glued on pasteboard, allows the production of another endless variety of forms of beauty, life, and knowledge. *Weaving of paper*, or instead of paper, straw, oilcloth, leather, silk ribbons of two colors, is another play productive of a great variety of forms, requiring skill, and furnishing great pleasure. *Cutting and gluing of paper* of square form, folded eight or six-fold, and cut with scissors in parallel, oblique, and finally in curved lines, then glued upon paper of different color, enables children of six or seven years of age to do another variety of fascinating work, and acquire good training of hand and eye. *Modeling* in clay or other plastic material, by means of a wooden board and wooden knife, is introduced for older pupils. The first forms made are those of regular geometrical bodies, and their methodical transformation into models of fruit, animals, vessels, and many simple forms of life, beauty, and knowledge.

"These are all the twenty gifts of Froebel, and we have enumerated them in the order of their introduction. But not one half of the time spent in the kindergarten is devoted to them. The occupation is frequently interrupted by conversation between teacher and child, which serves the purpose of guiding the work, rendering the child attentive, and able to express accurately his thoughts and feelings; and it is also interrupted for movement plays, recitations of childlike model poetry, with or without song, and also for gardening exercises. The real test of the merit of every exercise is the constant pleasure it affords to both pupil and teacher, and in the freshness and vigor of mind and body in which they result.

"Of the first importance is the conversation which accompanies every occupation.

"The language used must be simple conversation, occasional, prompted by the purpose of the play and supplementary to it.

"It is to excite the thoughts, feelings, and inclinations of the pupils, to guide them in their work, and to correct their expressions. It is to awaken their interest in the objects presented, to strengthen their moral feelings, and to widen their range of freedom.

"Experience in German-American kindergartens has established the fact, that through conversation and objective teaching, two, or even three, languages may be acquired with equal ease and perfection, as far as it is possible for young pupils to acquire language. The gardening exercises are to train the pupils to some skill in tending flowers and plants, to make them familiar with many of them, with their names, their parts, their qualities, and their uses; also, to engender a love for the study of nature, and a love for labor in the open air, by which their physical natures will be developed.

"It is evident from all we have said, that a genuine kindergartner, after Froebel's model, can hardly be educated to a sufficient degree for her high calling. Yet experience has shown that woman has a natural endowment for it; and that a year's, and even a half year's, theoretical and practical training, under the guidance of able teachers, has enabled many to become most successful kindergartners.

"The vocation is more inspiring, invigorating, and congenial than that of the common school teacher. The more mechanical portion of it can be rapidly learned; the more philosophical is the result of long experience and reflection, and requires for its acquisition a cheerful temper and the earnest devotion of a strong mind.

"Kindergartening should be a well paid profession, in order to attract to its application the noblest characters among women and the best talent. The individual blessings it would confer upon millions of children whose early education is now neglected, would tenfold more than compensate for all it would cost. It is a fact demonstrated by experience, that every child who is in the full enjoyment of the five senses can, through the aid of the kindergarten instruction, be developed into a harmoniously-educated man.

"An amount of talent and virtue quite incalculable, which now is lost to the individual and society through a lack of true instruction, or instruction begun at too late an age, when a majority of the child's powers, for the want of exercise, have gone to rest never to reawake, may be saved and made to inaugurate a new era for mankind.

"Now, when the question arises how Froebel's system, which has been so successfully adopted in Germany, Switzerland, Austria, Belgium, France, Russia, and Italy, may be made to benefit our own public schools, we meet with objections which may be briefly stated as follows:

"First—It has nowhere yet been connected with a system of public schools, but exists only in private and separate institutions.

"Second—A great majority of the pupils of our common schools spend less than three years in them; this time is barely sufficient for an elementary training, and cannot be wasted in less important employments.

"Third—A great majority of our teachers are scarcely able to cope with the severe task of an elementary training, such as is *now* demanded, and cannot be expected to master the greater difficulties of kindergarten education.

"Fourth—Two or three years of mere kindergarten instruction would seem to be a waste of time, in the view of impatient parents wishing their children to learn arithmetic, reading, and writing as rapidly as possible.

"All these objections are of an extrinsic nature; they do not touch the value of the system itself, the excellence of which is conceded by all persons of mature educational judgment acquainted with genuine kindergartens. The first objection, that Froebel's system has, as yet, nowhere been embodied in any system of common schools, is founded in fact, but it does not prove that this cannot be done. On the contrary, experience, such as has been derived from its introduction into some large German-American schools, proves beyond a doubt its applicability to any public school. Besides, where genuine kindergartens have existed long enough to prepare a number of ripe pupils for the primary schools, it is known that no other children come so well prepared for primary instruction, so easily controlled, and so eager for study They will not leave school after two or three years' attendance, if it can be helped, but will insist upon passing through the grammar and high school course. The second objection, that the pupils are for far too short a period attendants upon the public schools to lose any part of their time, is only partially founded in fact or reason. But let us suppose that, after the introduction of kindergarten instruction into our public schools, the average period of attendance were no longer

than three years, the result then, in the end, would show an advantage. After one or two years of kindergarten instruction, most of the pupils would have their powers so developed as not only to learn in the rest of their schooling period more than they now carry away, but also to be in after-life more zealous in mental improvement, more fit for any kind of labor, and more capable of culture in all its forms.

"The third objection is of a more serious nature. If the great majority of our teachers be too imperfectly prepared for their most responsible work, they can, of course, not be expected to master easily the greater difficulties of the kind of education proposed.

"The new kind of education may be begun with such teachers as we now have, at least in the cities and large towns, if the ablest of them are intrusted with kindergarten classes. They would raise pupils so well prepared for elementary training, that even less experienced and able teachers would do with *them* more creditable work.

"In these preparatory classes or grades, the great chasm should be bridged over that now lies between domestic education and our common elementary training. The latter, as it is in most schools, introduces the child to quite a new world at once. It presents to him mere signs, symbols, meaningless words, elements of an abstract nature, but it awakens in him no pleasure; it calls for no action, no movement; it leads to no proper development of either physical or mental power. It destroys individuality, and the hunger for facts and for activity; it stupifies beyond recovery many young minds, and retards the growth of all. It deters many pupils from entering school, or sends them from it long before they are prepared for life. Now, what we can do at once, and everywhere, to make the transition from domestic education to elementary school training gradual and agreeable, and conducive to a harmonious development of all the child's powers, is to devote the first year or year and a half of the school life of the child to kindergarten exercises, in connection with the simplest of Froebel's gifts. Parents and school Boards will not object to this, if the pupils learn in the second half of their time as much as they learned under the old plan in the whole, and especially if they learn so as to accomplish far higher results, and are happier in their work.

"The philosophy and methods of the kindergarten would gradually be adapted to the work of elementary training. Gradually, and in proportion to the improvement, would the gratitude of parents cause an increase in the teacher's compensation, and more and more persons born to be teachers would be attracted to the profession. The results of kindergarten instruction, and an increased demand for kindergarten teachers, would soon create a supply.

"But the fourth objection seems to be the most serious of all. It would seem to require a long and patient agitation of the subject by the teachers with the parents to weed out the prejudices of the latter, at present in the way of a general introduction of kindergartening. One of these prejudices is, that children cannot be sent too young to the primary school; another is, that the only task the child should undertake is the study of reading, writing, and arithmetic, and that all other occupations in school are a mere waste of time; another, that the play in school is to render the pupil averse to serious work.

"It has been shown that these objections are mere prejudices. Yet prejudices are of an obstinate growth, and a general agitation of the kindergarten idea in the educational periodicals, and in educational bodies, and in the papers, must be relied on, in part, for their overthrow.

"But the results of experiments on a progressive scale are far more convincing to the popular mind than the most eloquent arguments.

"Those who would learn to cherish the kindergartens must witness them in their working order and know of their results. It is evident that the kindergarten, when it is to be generally introduced in this country, should be in the most perfect and attractive form of which the system is so well capable, and that the only true way to that end would be through a model training school for kindergarteners. The high standard of philosophical and artistic work which would be set up in such an institution would, in a few years, scatter broadcast over the country hundreds of fully-prepared teachers, who, in their turn, could found model kindergarten schools. This model training school would suggest further adaptations of the system to the peculiar wants of this country. Still, action should not be delayed until we can have the model training school, and its benefits. We may have to wait for kindergarten schools, but not for many of their benefits.

"Your committee, therefore, propose the following resolutions:

"*Resolved*, (1) That this department of the National Teachers' Association, recognizing the kindergarten as a potent means for the elevation of primary education, and for the development and promulgation of the principles of sound educational psychology, do hereby recommend [the encouragement of] the establishment of kindergarten institutions, both public and private, and, also, of a normal institution for the special purpose of training kindergarten teachers.

"(2) That this department of the National Teachers' Association do hereby urge upon the attention of all practical educators and Boards of Education, the importance of initiating experiments with the intent to determine the best methods of connecting the kindergarten with our current educational system.

"(3) The Department recommend that all teachers study Froebel's system, in order to be instrumental in founding such institutions, and to hasten the advent of their general introduction."

EDUCATION AT THE CENTENNIAL.

The United States Commissioner of Education has invited this department to prepare for the centennial, a representation of the educational condition of California. But as such representation cannot be secured without the sanction and coöperation of the Legislature, I can do nothing more, at present, than to lay before that body the general plan adopted by the Centennial Commission and the Commissioner of Education, for the representation of the educational work and interests of the different States and territories. I need not dwell upon the vast national importance of this branch of our coming exposition. Baron von Schwartz-Senborn, who is "an old exposition man," having been the Austrian Commissioner at the exposition in Leipsic in eighteen hundred and fifty, in London in eighteen hundred and fifty-one, and eighteen hundred and sixty-two, in Paris in eighteen hundred and fifty-five, and eighteen hundred and sixty-seven, and the Director-General of the Vienna Exposition, says, after descanting upon the value of universal expositions

as "the very best schools," that "the educational departments of all nations represented at the Exposition at Vienna was the most interesting and most important part of the exposition. It was appreciated by all enlightened classes of men, by all those who are the well-wishers of the civilization and welfare of the people." I have no doubt that the educational section of the Exposition at Philadelphia "will, also, be the most valuable, and its consequences the most beneficial feature." It behooves the Legislature to see that California is fitly represented in this department, and according to the front rank in education it at present occupies in the land.

The following is the revised classification adopted by the Centennial Commission, which, of course, determines the plan of classification of this section of the exposition:

"DEPARTMENT III.—EDUCATION AND SCIENCE.

"EDUCATIONAL SYSTEMS, METHODS, AND LIBRARIES.

"CLASS 300.—Elementary instruction: Infant-schools and kindergarten, arrangements, furniture, appliances, and modes of training.

"Public schools: Graded schools, buildings and grounds, equipments, courses of study, methods of instruction, text-books, apparatus, including maps, charts, globes, etc.; pupils' work, including drawing and penmanship; provisions for physical training.

"CLASS 301.—Higher education: Academies and high schools.

"Colleges and universities: Buildings and grounds; libraries; museums, of zoölogy, botany, mineralogy, art, and archæology; apparatus for illustration and research; mathematical, physical, chemical, and astronomical courses of study; text-books, catalogues, libraries, and gymnasiums.

"CLASS 302.—Professional schools: Theology, law, medicine and surgery, dentistry, pharmacy, mining, engineering, agriculture and mechanical arts, art and design, military schools, naval schools, normal schools, commercial schools, music.

"Buildings, text-books, libraries, apparatus, methods, and other accessories for professional schools.

"CLASS 303.—Institutions for the instruction of the blind, the deaf and dumb, and the feeble-minded.

"CLASS 304.—Educational reports and statistics: National Bureau of Education; State, city, and town systems; college, university, and professional systems.

"CLASS 305.—Libraries: History, reports, statistics, and catalogues.

"CLASS 306.—School and text-books: Dictionaries, encyclopedias, gazetteers, directories, index volumes, bibliographies, catalogues, almanacs, special treatises, general and miscellaneous literature, newspapers, technical and special newspapers and journals, illustrated papers, periodical literature.

"INSTITUTIONS AND ORGANIZATIONS.

"CLASS 310.—Institutions founded for the increase and diffusion of knowledge: Such as the Smithsonian Institution, the Royal Institution, the Institute of France, the British Association for the Advancement of Science, and the American Association, etc., their organization, history, and results.

"CLASS 311.—Learned and scientific associations: Geological and mineralogical societies, etc. Engineering, technical and professional associations. Artistic, biological, zoölogical, medical societies, astronomical observatories.

"CLASS 312.—Museums, collections, art galleries, exhibitions of works of art and industry; agricultural fairs; State and county exhibitions; national exhibitions; international exhibitions; scientific museums and art-museums; ethnological and archæological collections.

"CLASS 313.—Music and the drama."

The following practical suggestions respecting the preparation of material for the exhibition of American education have been prepared by a committee appointed by the National Educational Association, and have been approved by the Director-General of the Exposition:

"The National Bureau of Education at Washington has been designated by the Centennial Commission as the central agency for carrying out the plans for the educational department, and as the organ of communication on the subject with State and municipal authorities, institutions, and individuals.

"It is recommended that the State educational authorities act as agents of their respective States in the preparation of the representation of the systems, institutions, and instrumentalities within the sphere and range of their official connection or authority. Where this recommendation is not carried into effect, and in respect to those educational interests not within the range of State authorities, all persons, organizations, or institutions desiring to participate are invited to communicate directly with the Bureau of Education.

"As the time now allowed for preparation is very brief, all will see the desirableness of giving early attention to what they propose to represent, and are requested, as above indicated, to communicate their plans, stating what they propose to exhibit, at their earliest convenience.

"In the representation of education, while unity and harmony must control the organization of the scheme, it is desired to consult and preserve the individuality of systems and institutions.

"To our education, in its various forms, we are accustomed as a people to trace the desirable elements of our civilization. To our education we attribute the security and perpetuity of our liberties.

"It is hoped that educators will embrace this opportunity to illustrate the connection between educational efforts and their results in the public welfare; and that there may be brought to this representation all exhibits showing the effect of education upon individual health; the sanitary condition of communities; showing education as a preventive of pauperism, vice, crime, and insanity; and as a means of increasing the products of industry and the sources of personal and social comfort and confirming individual and civil virtue.

"For the purpose of utilizing and extending the benefits of the Exhibition, one of the most important instrumentalities is that of reports thereon of competent experts, and it is therefore suggested as desirable that, in all cases where it is practicable, educational authorities, organizations, and institutions should designate suitably qualified persons to examine and report on classes, groups, or individual objects.

"In view of the importance of education in its relation to individual and social progress and well being; in view of its necessity under our

form of government, which gives to all the rights and imposes upon all the duties of citizenship; in view of the probable fact that more foreigners will visit the Centennial Exposition to see our school material and study our school system than for any other purpose, it is urged that all persons connected with the work of education and all educational institutions shall unite in the effort to make the exhibition of our school interests at Philadelphia a credit to the nation.

"In order that persons desiring to coöperate may not waste time in trying to learn what the material of the proposed Exhibition should consist of, the following more particularized suggestions have been prepared at the request of the Commission:

"ELEMENTARY AND SECONDARY INSTRUCTION.

"BUILDINGS AND GROUNDS.

"There should be full-sized specimen buildings for infant schools and kindergarten schools, the 'national school,' or the ungraded country school, the graded village school with from three to six rooms, with the whole of their belongings and equipments, from different States of our country and from foreign countries. There should also be exhibited a full-sized American pioneer log school house, with its appropriate fittings and furniture, as an interesting and significant illustration of an important agency in our civilization, as well as adobe and sod school houses from the Southwest and Northwest; also a structure comprising a model school room, with all its belongings, adapted to a large village or city elementary school building, with many school or class rooms, this structure not pretending to be a model school house. Views; elevations, perspectives, and plans in drawings; photographs and engravings; historical, representative, and ideal educational buildings; and samples of the best public school edifices—rural, village, and city—with working plans, ought also to be presented. There should be graphic representations of heating and ventilating apparatus and appliances, photographs and drawings of interiors, photographs of interiors with pupils in various situations, for the stereoscope (of which interesting specimens were sent from New York to the Vienna Exposition.)

"Views and plans should be marked with the dimensions of buildings and date of erection. Representations of buildings unique in character and excellence should be prepared for wall exhibition. Others should be put up in portfolios, lettered with the designation of the State and city or town, and name of school or institution, and accompanied with printed or manuscript description of the peculiar features, with the cost, material of construction, date of erection, name of architect, etc. Special representations and descriptions of improved arrangements and apartments, such as drawing rooms, lecture rooms, chemical laboratories, apparatus cabinets, assembly halls, rooms for gymnastic exercises, play rooms, clothes rooms, teachers' rooms, teachers' conference rooms, recitation school rooms, vestibules, water closets, etc., are desirable.

"Plans of grounds, with dimensions, points of compass, and location of building indicated; examples of architectural skill in adapting buildings with symmetrical rooms to irregular city lots; maps of grounds, showing the designs for ornamentation; representations of school gardens, and designs for the same, are also appropriate.

"FURNITURE AND FITTINGS.

"Teachers' desks, tables, and chairs; scholars' desks, tables, benches, chairs, and settees; approved specimens of such as are in actual use, from State and municipal authorities and institutions; historical specimens illustrating progress; contributions from inventors and manufacturers—only one specimen of a type, and not all the sizes; accompanying statements of peculiar features and supposed excellences and advantages of dimensions, respective heights of seat and desk of each size, and relative position of seat and desk as to distance (prices in detail); cabinets for specimens of natural history and apparatus; cases for reference and library books, for portfolios of drawings, etc.; contrivances for the preservation and suspension of maps, window shades, inside blinds, etc., should be exhibited.

"All articles of this class should be *samples* in the true sense of the word—that is, such in quality, as respects material and finish, as those in use or made for sale.

"APPARATUS AND APPLIANCES.

"These should consist of kindergarten 'gifts,' and all the materials for illustrative instruction and object teaching, and for scholars' work in infant schools and kindergarten; also model samples of every kind of apparatus requisite for teaching in the ungraded country school and in the graded village or city school the rudiments of natural history, physics, chemistry, and geometry; specimens of apparatus for the more advanced teaching of the same branches in high schools and academies; globes and maps, the same in relief; maps with special regard to orographical, hydrographical, topographical, climatographical, ethnographical, historical, and statistical particulars; collections and pictures for geographical and historical instruction of different grades; charts and tablets of every kind used in elementary and secondary instruction; atlases, slates, writing books, drawing books and cards, copies, examples, and models for drawing, wire and plastic models for teaching projections and perspective, and all other materials and apparatus for teaching industrial drawing; crayons, pencils and pens, blackboards, erasers and pointers; grading, reckoning, and writing machines; inkwells and inkstands; clocks, bells, and gongs; merit cards, merit rolls, registers and record books, blank forms of statistical reports, diplomas and medals; uniforms and military equipments; book sacks, book knapsacks, book carriers, and lunch boxes.

"Offers of contributions of all sorts of educational apparatus and appliances are solicited from educational authorities, the managers and proprietors of institutions, inventors, manufacturers, and dealers.

"TEXT-BOOKS AND BOOKS OF REFERENCE.

"There will necessarily be considerable duplication in this division. In the first place, it is desirable to have several complete sets of text-books actually prescribed and used in the unclassified country school and the different grades of classified public schools, from different foreign nations, and from different parts of our own country, as well as in representative institutions for secondary, collegiate, professional, and special schools, in their ordinary binding; then from publishers, col-

lective sets of their text-book publications, of whatever description or grade; and, finally, sets from authors of their respective productions; samples of the most complete sets of books of reference provided for elementary schools and in actual use; also the same in respect to secondary schools, and accompanying statements of the prices of text-books; catalogues of books of reference in higher and professional schools. With collections of books, cases should be sent of suitable size, and shelving to contain them. The cases should be neat, but without ornament, with glazed doors; they should be of uniform height for convenience and comeliness of installation, the requisite diversity of capacity being secured by varying the width according to the bulk of the books to be contained, or by multiplying the number of cases. The cases should be exactly four feet high or exactly two feet high, with no bottom or top ornament except simple moldings, and these must not extend beyond the above designated dimensions. The depth of the cases may conform to the sizes of the books to be contained. They should be of dark colored wood, or stained to resemble such.

"SCHOLARS' WORK.

"This is an extremely important division of the educational exhibition, though, with the exception of drawing, it is not showy in its character. It is not an easy task to arrange a satisfactory scheme, nor will it be easy to carry out the best arranged plan. Much must be left to the taste, judgment, invention, and fidelity of teachers. Although the results of instruction belong to the mind, yet they are to a great degree capable of ocular representation, and all written examinations are based upon this presumption, and upon a little reflection it will be perceived that the scope of this division is very large. It comprises every exercise and performance that is susceptible of a graphic representation; all the work of the pen and pencil, and, in addition, mechanical constructions and productions, modelings and carvings, whether imitations or original designs.

"It is essential that each exhibit should be just what it purports to be, and each collection of papers bound up together, or in any way arranged in a set, and each separate individual paper or production should carry on its face a distinct indication of the facts as to its execution necessary to judge of its merits: such as the grade or kind of institution or school; the class in the institution or school; whether a first draught or a copy; time allowed; age and sex of pupils doing the work; whether selected specimens or work of entire class; whether a general examination, an exercise in review, or a regular lesson, with usual time of preparation; date of the performance; whether a copy or an original design; in drawing, whether from flat or round; whether done with reference to the exhibition or taken from ordinary routine work; the county and State, with the town or city. It is obvious that productions, without the indication of the essential facts as to their execution, have little or no value for purposes of comparison, and, therefore, for the purposes of an instructive exhibition.

"It is hardly necessary to attempt an exhaustive enumeration in detail of all descriptions of scholars' work which might be useful for exhibition. The limits of this programme will permit only the most essential suggestions and directions.

"The following should be exhibited:

"Kindergarten-work, and the work of pupils in kindergarten training-schools.

"Primary school-slates, with printing, writing, Arabic and Roman figures, drawing, and musical notes, done by classes of pupils, put up like drawers in a rack made for the purpose, twelve in a rack.

"Writing-books completed, attached together in volumes, of all grades. Specimens of writing should be written on paper of the size and shape of an ordinary writing-book leaf, unruled, ruled by hand, or machine-ruled for the purpose, and neatly bound, the work of a school or class in a volume; individual specimens, on larger paper, of ornamental penmanship, for portfolios or framed for wall exhibition.

"Drawing-books completed, attached in volumes; drawings bound in volumes and in portfolios, also, specimens for wall exhibition; portfolio of two or three specimens of different kinds, freehand, geometrical, etc., of each grade of a public school course, from the lowest primary class to the highest in the secondary or high school.

"The drawings from industrial classes, schools of design, technological schools of different kinds, and schools of fine arts, will doubtless constitute one of the most attractive and useful features of the exhibition. Contributions illustrating the courses in drawing, and the results attained in each institution of the above classes are desired. They should be loose in portfolios, from which selections may be made for wall display on an extensive scale.

"Models of bridges and other engineering projects and designs; models of building construction; specimens of carving and modeling in clay; samples of the productions of machine shops connected with technical schools; apparatus of any description made by students.

"Map-drawing, from memory and from copy, with and without printed skeleton; paper of the size of the leaf of the ordinary quarto school atlas; written exercises, comprising English compositions, themes and translations in different languages; exercises in the various elementary branches; exercises in the higher studies, literary, scientific, æsthetic, professional, and technological; specimens of graduating dissertations, orations, and theses.

"Written exercises should, as a rule, especially those of an elementary character, be of the regular letter-sheet size, with margin for binding, unruled, ruled by hand, or machine-ruled. They should be neatly and plainly bound in muslin, in volumes of moderate thickness.

"As it is desirable to encourage girls' handiwork in school, it is hoped that specimens of both plain and ornamental will be contributed. The smaller articles may be conveniently arranged for exhibition in large portfolios with card-board leaves. Larger ones may be placed in vertical or horizontal show-cases. If girls have learned, in schools, to cut and make their own dresses, samples should be sent.

"It is suggested that exercises prepared especially for the exhibition be commenced simultaneously on the first of February, eighteen hundred and seventy-six.

"INSTITUTION FOR SUPERIOR AND PROFESSIONAL INSTRUCTION.

"So far as applicable, it is desirable that the foregoing suggestions be regarded.

"The following additional suggestions are recommended to the authorities of universities and colleges:

"DIAGRAMS AND MAPS OF BUILDINGS AND GROUNDS.

"The managers of such institutions should present a map of the ground, showing location of buildings, as already located and erected, together with the site, in dotted outline, of those that are to be built according to the existing plans. It is estimated that a scale of one foot to one thousand three hundred and twenty feet, or a quarter of a mile to a foot, would be sufficient for this purpose. The map should include only the college or university grounds proper, and not any farming or other lands that may be owned. An exception to this, however, should be made in the case of agricultural colleges, where experimental farms and premises used for practical instructions should be given in detail, while whatever features are incident to this purpose might be fully represented. Where disconnected grounds are occupied by these institutions, separate maps of each might be given, and in some cases a small outline-map of the city or town, showing relative location and distances.

"Ground-plans of college-buildings, showing internal arrangements of different parts, would be very desirable. A scale of one foot to two hundred and seventy, or about twenty-two feet to the inch, is thought most convenient for this purpose, and there may be as many of these as are thought necessary for representing the essential features. A marginal table of reference would explain the uses of the various apartments.

"PHOTOGRAPHIC VIEWS.

"Photographic or other views of buildings, in number sufficient to represent the extent, style of architecture, and appearance, would be very important. They should not be larger than that known to photographers as four-by-four size (six and one half by eight and one half inches), and might be in sufficient number to fully present the important buildings of the institutions.

"SPECIAL HISTORIES.

"The present is thought to be a most favorable opportunity for the preparation of special histories of colleges and universities. If prepared, their extent, plan, scope, and mode of illustration would depend upon the judgment of their authors, and would, it is believed, tend greatly to advance the interest felt in these institutions, by making them more fully known.

"PORTRAITS OF EDUCATORS.

"A series of portraits of presidents of colleges and of faculties and distinguished founders, benefactors, and friends, as well past as present, would be highly desirable.

"CATALOGUES.

"Series of college catalogues and of other publications would be of great importance, and, if furnished, should be substantially bound and placed under such regulations as might render them convenient for reference. In each of the foregoing objects, its execution must depend upon the interest felt in the subject by the institutions themselves, as no appropriations have been made for these objects, nor can payment be promised. Means will, however, be found, consistent with good

taste, under such general regulations as may be adopted by the Centennial Commission, for making known to those desirous of procuring copies the persons from whom or places at which they may be procured.

"It is furthermore confidently hoped that the importance of having a permanent collection of these objects at a central repository will be felt by those who may furnish them, and that they will allow one copy of each to remain permanently in the care of the Bureau of Education at Washington, where they will be carefully kept for public reference and use, under such regulations as may tend to prevent injury or loss.

"CONCISE HISTORIES OF INSTITUTIONS.

"Finally, and as deemed most important of all, because it will be altogether the most lasting and valuable, will be a *concise history of each institution embraced in the plan.* This will be included in the official publications of the Government, and will find its way into the principal public libraries in this and other countries, within reach of any person who may now or hereafter have occasion to refer to the information therein contained.

"Full credit of authorship will be given to these several summaries, and such generalizations, statistical results, and illustration by maps and diagrams will be made as the subject will admit. It is highly desirable that engravings of plans and views of buildings and grounds should accompany these condensed histories, but this, if done, must be at the expense of the institutions. The engravings, or an electrotype copy, will, however, be returned to those procuring them with a view to their use in catalogues and other publications for which there may be occasion in the future. These should be of the octavo size, and advice will be more fully given concerning them at an early day.

"A limit to these summary histories will be stated after some preliminary inquiries shall have been completed; and every effort will be made to secure a perfectly fair and impartial opportunity to each institution, without prejudice or preference.

"In the arrangement of these summary histories, and in the deductions and generalizations that may be drawn from them, the subject will be distinctly and prominently presented *by States*, preceded by a general statement of the policy and plan that have been pursued in each for the encouragement and regulation of its higher seminaries of learning. A general summary of general results will also be prepared.

"As to the subject matter of these summaries, they should show the general facts:

"(1.) Name of the college or university, and its origin and changes, with the reasons therefor.

"(2.) Date of organization and incorporation; denominational or other control.

"(3.) Location, and the reasons that determined it.

"(4.) Brief notices of founders and patrons.

"(5.) Description of buildings; extent of college grounds and of other lands and estates.

"(6.) General or special objects and original plan of organization, with its subsequent modifications and present status.

"(7.) Preliminaries of organization and brief notice of academic or other institutions from which it may have sprung, with dates of their establishment, their changes, etc.

"(8.) Summary of special legislation relating to the institution, and

of the decisions of Courts affecting property or rights, with reference to documentary and other authorities, in which these can be studied in detail.

"(9.) Relation to or dependence upon State governments, and patronage or grants from State or General Government, with dates, amounts received, or other information concerning them.

"(10.) Extent and history of local, denominational, or other endowments; their income, investment, and limitations. These may often be most concisely stated in tabular forms.

"(11.) Number of Trustees, visitors, or other controlling officers; their mode of election and tenure or term.

"(12.) Organization of the faculty, their mode of election, tenure, powers, etc.

"(13.) Course and plan of study, with important changes from time to time. Methods of instruction.

"(14.) Departments of professional or special study, with historical statement of formation and changes.

"(15.) Libraries, cabinets, laboratories, observatories, apparatus, art-galleries, gymnasiums, and other accessories.

"(16.) College societies, with facts and statistics, dates of formation, discontinuance, consolidations, and changes. These may often be concisely presented in tabular form.

"(17.) Financial statements; expenses to students; scholarships; prizes, etc.

"(18.) Lists of graduates, which will be sufficiently presented in copies of the last general catalogue with supplement added.

"(19.) Such statements as facts may justify in relation to the work accomplished by the institution, of course avoiding invidious comparisons with other institutions.

"INSTRUCTION FOR THE BLIND, DEAF-MUTE, ETC.

"Schools for the blind, deaf-mute, etc., are requested to exhibit the peculiar features of their instruction, such as:

"For the instruction of the blind: Specimens of printing, with the presses by which they were executed; samples of the literature printed; contrivances for aiding in writing, in teaching numbers and geography.

"For the deaf and dumb: Graphic illustrations of the mechanism of speech as applied to articulation and lip reading, and of the application of visible speech to articulation; practicing mirrors, and books for teaching reading.

"For the feeble minded: Apparatus for physical development and illustrative teaching in the different stages of progress.

CONCLUSION.

The highest and best interests of our republic are indissolubly bound up in our public school system. No one can pretend that this system is even theoretically perfect, much less that it produces in practice "the utmost measure of success." The system is still in its infancy, and it is therefore of vital importance for us to determine whether it has been started in "the right lines," for "the process of undoing is sometimes more difficult and laborious than that of constructing." More than twenty-five years' active connection with public schools has convinced me, and the testimony of other educators east and west, north and south, bears me out in this, that in very many features of the internal economy of our system we have not yet started in "the right lines;" and loving as I do our system, and with the firm conviction that our schools are our "country's hope," I have deemed it my duty, while giving full credit to our grand educational record, to point out unfalteringly the shortcomings of our system. If my criticisms seem sometimes harsh, I believe it will be found to be only "the harshness of an unwelcome truth." California's progress in education is a surprise and admiration to older communities; and I firmly trust and believe that California will yet be hailed as the pioneer in paving the way for "the sure coming of the golden age" of education. California has already taught many a useful lesson in popular education to her sisters of the East; she has unexcelled opportunities of exemplifying "the new education," and her intelligent and sympathetic people and Legislature will not neglect these opportunities.

In giving her State Board of Education full power to prescribe a course of study and a series of text-books for the public schools of the whole State, California has to hand an agency by means of which, on the one hand, her schools can be freed from the crushing tyranny of the text-book, and on the other hand, her teachers be supplied with a well-contrived course of study, and the necessary instruction to carry out this course according to its letter and spirit. In using the fund now required for teachers' institutes and Boards of Examination for the establishment of normal institutes, California can give every public school teacher at least a modicum of technical training, until such time when she is in position to exact a full professional training from every candidate for the profession. In short, her present system of education gives California the power to enforce in her schools the course of study most in accord with our present age, and to have this course taught according to the teaching of the most competent pedagogists of the world. If, in addition to this, the necessary steps are taken, first, to exact the full measure of efficiency from the present system of school supervision, and secondly, to insure to our schools a sufficient length of school terms, our system will soon reach its highest point of excellence, and will then be found to have no peer in the world.

In the extracts from the County Superintendents' reports given in the Appendix, reference is made to several amendments needed in our present school law. The most important amendment, not yet spoken of by me, is the change asked for in the time for holding Trustees' election. The last Saturday in April is a far preferable time to the last Sat-

urday of June, as the latter is in the midst of harvest, when a majority of farmers will not and cannot leave their work to attend school meetings.

I now retire from an office which I entered with a great deal of hesitancy and many forebodings. I brought to it many firm convictions, the growth of a decade spent in the school-room; and, according to these convictions have I labored to perfect our system of education; and I feel that I need not fear the verdict of the future. I have at least succeeded in equalizing somewhat the educational facilities enjoyed by the districts of the State, and in rationalizing, in some measure, the system of instruction, and bringing it somewhat more in harmony with the "new education."

HENRY N. BOLANDER,
Superintendent Public Instruction.

State of California,
County of Sacramento, } ss.

I, Henry N. Bolander, Superintendent of Public Instruction, do hereby certify that the appropriation made for the office of Superintendent of Public Instruction, for "Traveling Expenses," "Postage and Expressage," and "Contingent Expenses," for the twenty-fifth and twenty-sixth fiscal years, were expended in the payment, respectively, of traveling expenses, postage, expressage, and telegraphing, and soap, towels, subscriptions to newspapers, and other necessary expenses of the office; as will fully appear by reference to the vouchers on file in the office of the Controller of State.

HENRY N. BOLANDER,
Superintendent of Public Instruction.

APPENDIX.

I. STATISTICAL TABLES.

II. REPORTS FROM COUNTY SUPERINTENDENTS.

III. PUBLIC SCHOOL BUILDINGS.

TABLE No. 1.

Census statistics for the school years ending June thirtieth, eighteen hundred and seventy-four and eighteen hundred and seventy-five.

COUNTIES.	Number of White Children between Five and Seventeen Years of Age.					
	1874.			1875.		
	Boys.	Girls.	Total.	Boys.	Girls.	Total.
Alameda	4,051	4,077	8,128	4,600	4,627	9,227
Alpine	53	44	97	45	40	85
Amador	1,172	1,092	2,264	1,194	1,163	2,357
Butte	1,554	1,504	3,058	1,724	1,691	3,415
Calaveras	1,166	1,120	2,286	1,116	1,084	2,200
Colusa	1,021	985	2,006	1,233	1,079	2,312
Contra Costa	1,460	1,376	2,836	1,554	1,482	3,036
Del Norte	196	187	383	218	190	408
El Dorado	1,212	1,167	2,379	1,157	1,112	2,269
Fresno	584	501	1,085	719	648	1,367
Humboldt	1,214	1,135	2,349	1,391	1,335	2,726
Inyo	152	164	316	188	204	392
Kern	397	357	754	504	483	987
Klamath*	125	87	212	......	......	......
Lake	575	631	1,206	649	701	1,350
Lassen	328	332	660	326	336	662
Los Angeles	3,528	3,478	7,006	3,940	3,743	7,683
Marin	977	649	1,626	899	736	1,635
Mariposa	425	419	844	436	441	877
Mendocino	1,277	1,216	2,493	1,344	1,296	2,640
Merced	602	570	1,172	573	581	1,154
Modoc	498	413	911	442	403	845
Mono	64	39	103	68	43	111
Monterey	1,485	1,354	2,839	1,697	1,569	3,266
Napa	1,290	1,272	2,562	1,405	1,384	2,789
Nevada	2,285	2,207	4,492	2,349	2,319	4,668
Placer	1,259	1,156	2,415	1,284	1,222	2,506
Plumas	407	384	791	424	395	819
Sacramento	2,996	3,041	6,037	3,238	3,151	6,389
San Benito	703	636	1,339	748	707	1,455
San Bernardino	944	861	1,805	1,041	914	1,955
San Diego	870	797	1,667	897	869	1,766
San Francisco	18,774	19,128	37,902	20,243	20,615	40,858
San Joaquin	2,445	2,594	5,039	2,548	2,622	5,170
San Luis Obispo	953	884	1,837	1,065	938	2,003
San Mateo	1,105	1,003	2,108	1,219	1,119	2,338
Santa Barbara	1,000	912	1,912	1,171	1,100	2,271
Santa Clara	3,791	3,875	7,666	4,176	4,172	8,348
Santa Cruz	1,558	1,416	2,974	1,662	1,518	3,180
Shasta	699	645	1,344	709	669	1,378
Sierra	524	560	1,084	541	566	1,107
Siskiyou	787	757	1,544	816	800	1,616
Solano	2,249	2,138	4,387	2,358	2,228	4,586
Sonoma	3,286	3,162	6,448	3,540	3,379	6,919
Stanislaus	936	890	1,826	998	902	1,900
Sutter	716	757	1,473	754	784	1,538
Tehama	662	660	1,322	658	709	1,367
Trinity	287	260	547	328	281	609
Tulare	1,131	1,018	2,149	1,456	1,349	2,805
Tuolumne	1,005	910	1,915	972	872	1,844
Ventura	530	481	1,011	588	533	1,121
Yolo	1,219	1,162	2,381	1,277	1,257	2,534
Yuba	1,293	1,228	2,521	1,281	1,259	2,540
Totals	79,820	77,691	157,511	85,763	83,620	169,383

* Disorganized in 1874.

Table No. 1—Continued.

COUNTIES.	Number of Negro Children between Five and Seventeen Years of Age.					
	1874.			1875.		
	Boys.	Girls.	Total.	Boys.	Girls.	Total.
Alameda	33	48	81	39	53	92
Alpine	......	......	......	......	......	......
Amador	14	13	27	12	12	24
Butte	17	12	29	18	10	28
Calaveras	3	3	6	2	1	3
Colusa	13	9	22	14	5	19
Contra Costa	4	1	5	3	5	8
Del Norte	......	......	......	1	2	3
El Dorado	16	11	27	14	16	30
Fresno	5	1	6	9	1	10
Humboldt	1	......	1	2	2	4
Inyo	......	3	3	......	2	2
Kern	1	......	1	3	2	5
Klamath*	......	......	......	......	......	......
Lake	......	1	1	......	1	1
Lassen	......	......	......	......	......	......
Los Angeles	37	23	60	31	12	43
Marin	......	2	2	3	4	7
Mariposa	11	16	27	10	12	22
Mendocino	2	2	4	2	1	3
Merced	8	2	10	11	4	15
Modoc	......	......	......	......	......	......
Mono	......	......	......	......	......	......
Monterey	9	4	13	9	6	15
Napa	15	10	25	14	11	25
Nevada	17	20	37	19	14	33
Placer	1	3	4	4	3	7
Plumas	......	......	......	......	......	......
Sacramento	45	31	76	50	35	85
San Benito	......	......	......	1	......	1
San Bernardino	3	5	8	2	4	6
San Diego	7	5	12	6	7	13
San Francisco	95	87	182	87	76	163
San Joaquin	23	23	46	23	19	42
San Luis Obispo	......	......	......	......	3	3
San Mateo	3	1	4	1	1	2
Santa Barbara	2	2	4	4	2	6
Santa Clara	27	24	51	18	34	52
Santa Cruz	20	11	31	16	13	29
Shasta	6	3	9	4	3	7
Sierra	4	3	7	4	2	6
Siskiyou	12	7	19	16	6	22
Solano	21	9	30	16	10	26
Sonoma	11	11	22	11	8	19
Stanislaus	7	2	9	9	......	9
Sutter	......	1	1	5	4	9
Tehama	23	18	41	23	20	43
Trinity	3	3	6	3	1	4
Tulare	8	4	12	13	8	21
Tuolumne	10	14	24	10	10	20
Ventura	......	......	......	......	......	......
Yolo	8	6	14	10	12	22
Yuba	35	30	65	23	35	58
Totals	580	484	1,064	575	492	1,067

* Disorganized in 1874.

TABLE No. 1—Continued.

COUNTIES.	Number of Indian Children between Five and Seventeen Years of Age.					
	1874.			1875.		
	Boys.	Girls.	Total.	Boys.	Girls.	Total.
Alameda	4	7	11	6	5	11
Alpine	....	....	....	....	....	....
Amador	4	2	6	....	....	....
Butte	27	12	39	27	14	41
Calaveras	3	5	8	7	6	13
Colusa	6	7	13	9	6	15
Contra Costa	3	7	10	3	....	3
Del Norte	21	15	36	21	16	37
El Dorado	30	12	42	20	16	36
Fresno	35	20	55	12	9	21
Humboldt	36	16	52	71	62	133
Inyo	....	....	....	2	1	3
Kern	1	3	4	1	4	5
Klamath*	42	37	79	....	....	....
Lake	3	4	7	9	9	18
Lassen	1	2	3	2	3	5
Los Angeles	33	25	58	38	23	61
Marin	4	4	8	3	2	5
Mariposa	16	3	19	22	9	31
Mendocino	84	67	151	91	74	165
Merced	....	....	....	2	....	2
Modoc	37	20	57	1	....	1
Mono	1	....	1	1	....	1
Monterey	6	3	9	1	4	5
Napa	8	4	12	2	6	8
Nevada	2	1	3	3	1	4
Placer	5	2	7	4	2	6
Plumas	1	....	1	11	4	15
Sacramento	7	4	11	6	2	8
San Benito	....	....	....	....	....	....
San Bernardino	10	2	12	5	5	10
San Diego	33	16	49	35	20	55
San Francisco	2	7	9	....	....	....
San Joaquin	....	....	....	....	....	....
San Luis Obispo	3	3	6	2	4	6
San Mateo	2	1	3	....	....	....
Santa Barbara	....	2	2	4	1	5
Santa Clara	7	....	7	5	5	10
Santa Cruz	3	....	3	3	....	3
Shasta	62	58	120	71	61	132
Sierra	....	....	....	2	....	2
Siskiyou	24	10	34	39	28	67
Solano	4	9	13	11	7	18
Sonoma	39	17	56	30	35	65
Stanislaus	....	....	....	....	....	....
Sutter	3	1	4	....	2	2
Tehama	10	8	18	6	9	15
Trinity	32	11	43	20	9	29
Tulare	10	6	16	6	5	11
Tuolumne	4	2	6	3	5	8
Ventura	10	5	15	1	....	1
Yolo	7	2	9	7	3	10
Yuba	9	6	15	4	7	11
Totals	694	448	1,142	629	484	1,113

* Disorganized in 1874.

TABLE No. 1—Continued.

COUNTIES.	Total Number of Census Children between Five and Seventeen Years of Age.	
	1874.	1875.
Alameda	8,220	9,330
Alpine	97	85
Amador	2,297	2,381
Butte	3,126	3,484
Calaveras	2,300	2,216
Colusa	2,041	2,346
Contra Costa	2,851	3,047
Del Norte	419	448
El Dorado	2,448	2,335
Fresno	1,146	1,398
Humboldt	2,402	2,863
Inyo	319	397
Kern	759	997
Klamath	291	....
Lake	1,214	1,369
Lassen	663	667
Los Angeles	7,124	7,787
Marin	1,636	1,647
Mariposa	890	930
Mendocino	2,648	2,808
Merced	1,182	1,171
Modoc	968	846
Mono	104	112
Monterey	2,861	3,286
Napa	2,599	2,822
Nevada	4,532	4,705
Placer	2,426	2,519
Plumas	792	834
Sacramento	6,124	6,482
San Benito	1,339	1,456
San Bernardino	1,825	1,971
San Diego	1,728	1,834
San Francisco	38,098	41,021
San Joaquin	5,085	5,212
San Luis Obispo	1,843	2,012
San Mateo	2,115	2,340
Santa Barbara	1,918	2,282
Santa Clara	7,724	8,410
Santa Cruz	3,008	3,212
Shasta	1,473	1,517
Sierra	1,091	1,115
Siskiyou	1,597	1,705
Solano	4,430	4,630
Sonoma	6,526	7,003
Stanislaus	1,835	1,909
Sutter	1,478	1,549
Tehama	1,381	1,425
Trinity	596	642
Tulare	2,177	2,837
Tuolumne	1,945	1,872
Ventura	1,026	1,122
Yolo	2,404	2,566
Yuba	2,601	2,609
Totals	159,717	171,563

TABLE No. 1—Continued.

COUNTIES.	Number of Children Under Five years of age in 1874.			
	White.	Negro.	Indian.	Total.
Alameda	4,173	32	2	4,207
Alpine	66	....	....	66
Amador	1,018	6	....	1,024
Butte	1,282	10	4	1,296
Calaveras	765	....	2	767
Colusa	1,111	9	1	1,121
Contra Costa	1,303	....	1	1,304
Del Norte	184	....	8	192
El Dorado	838	13	14	865
Fresno	580	4	7	591
Humboldt	1,106	2	9	1,117
Inyo	215	....	....	215
Kern	380	....	....	380
Klamath	....	....	....	....
Lake	592	....	1	593
Lassen	377	....	....	377
Los Angeles	2,649	11	3	2,663
Marin	787	....	3	790
Mariposa	325	8	3	336
Mendocino	1,223	4	34	1,261
Merced	564	7	....	571
Modoc	351	3	4	358
Mono	62	....	....	62
Monterey	1,324	1	3	1,328
Napa	1,166	11	2	1,179
Nevada	1,816	15	2	1,833
Placer	979	3	2	984
Plumas	412	....	....	412
Sacramento	2,709	20	....	2,729
San Benito	710	1	....	711
San Bernardino	780	2	....	782
San Diego	638	5	12	655
San Francisco	21,087	84	1	21,172
San Joaquin	1,996	31	....	2,027
San Luis Obispo	844	....	7	851
San Mateo	1,055	1	....	1,056
Santa Barbara	876	2	2	880
Santa Clara	3,491	8	....	3,499
Santa Cruz	1,388	7	....	1,395
Shasta	543	....	27	570
Sierra	511	2	....	513
Siskiyou	646	2	8	656
Solano	2,051	8	2	2,061
Sonoma	2,785	2	16	2,803
Stanislaus	832	....	....	832
Sutter	728	....	....	728
Tehama	508	12	....	520
Trinity	238	1	12	251
Tulare	974	2	....	976
Tuolumne	585	4	....	589
Ventura	504	....	12	516
Yolo	1,136	1	1	1,138
Yuba	1,059	14	1	1,074
Totals	74,322	348	206	74,876

TABLE No. 1—Continued.

COUNTIES.	Number of Children Under Five years of age in 1875.			
	White.	Negro.	Indian.	Total.
Alameda	4,596	48	....	4,644
Alpine	55	....	....	55
Amador	1,017	9	1	1,027
Butte	1,493	8	16	1,517
Calaveras	718	....	....	718
Colusa	1,179	4	4	1,1[illegible]7
Contra Costa	1,370	....	....	1,370
Del Norte	157	....	8	165
El Dorado	848	11	12	871
Fresno	674	5	4	683
Humboldt	1,343	3	47	1,393
Inyo	196	....	....	196
Kern	490	....	2	492
Klamath	....	....	....	....
Lake	648	....	3	651
Lassen	328	....	1	329
Los Angeles	3,109	8	12	3,129
Marin	752	....	6	758
Mariposa	321	8	8	337
Mendocino	1,312	3	35	1,350
Merced	576	2	....	578
Modoc	340	....	....	340
Mono	66	....	....	66
Monterey	1,437	2	2	1,441
Napa	1,356	8	5	1,369
Nevada	1,866	15	....	1,881
Placer	1,019	5	....	1,024
Plumas	410	....	6	416
Sacramento	1,102	34	2	1,138
San Benito	770	....	....	770
San Bernardino	804	1	....	805
San Diego	648	4	11	663
San Francisco	22,928	96	....	23,024
San Joaquin	2,103	20	....	2,123
San Luis Obispo	974	....	....	974
San Mateo	1,130	....	....	1,130
Santa Barbara	1,074	6	4	1,084
Santa Clara	3,447	21	....	3,468
Santa Cruz	1,414	7	1	1,422
Shasta	541	....	31	572
Sierra	518	....	....	518
Siskiyou	693	6	14	713
Solano	2,083	3	4	2,090
Sonoma	2,964	4	11	2,979
Stanislaus	835	2	....	837
Sutter	709	4	....	713
Tehama	640	10	3	653
Trinity	273	....	6	279
Tulare	1,348	2	....	1,350
Tuolumne	519	1	....	520
Ventura	532	....	2	534
Yolo	1,215	9	....	1,224
Yuba	1,063	16	1	1,080
Totals	78,003	385	262	78,650

TABLE No. 1—Continued.

COUNTIES.	Number of Children between Five and Seventeen years of age who have attended Public Schools at any time during the year 1874.			
	White.	Negro.	Indian.	Total.
Alameda	5,498	51	2	5,551
Alpine	91			91
Amador	1,802	16		1,818
Butte	2,314	16	6	2,336
Calaveras	1,690		4	1,694
Colusa	1,401	4		1,405
Contra Costa	1,974		3	1,977
Del Norte	274		13	287
El Dorado	1,863	13	17	1,893
Fresno	638		15	653
Humboldt	1,650		9	1,659
Inyo	249			249
Kern	390		2	392
Klamath	192			192
Lake	895			895
Lassen	496		1	497
Los Angeles	3,389	30		3,419
Marin	1,003		5	1,008
Mariposa	550	22		572
Mendocino	1,899		21	1,920
Merced	906	9		915
Modoc	645		1	646
Mono	85			85
Monterey	1,710	5	1	1,716
Napa	1,782	22	2	1,806
Nevada	3,253	26	1	3,280
Placer	1,934			1,934
Plumas	583		1	584
Sacramento	4,086	48	4	4,138
San Benito	862			862
San Bernardino	1,089	3		1,092
San Diego	827	1	3	831
San Francisco	23,537	85		23,622
San Joaquin	3,911	29		3,940
San Luis Obispo	925		1	926
San Mateo	1,329	2	1	1,332
Santa Barbara	779	1		780
Santa Clara	4,825	21		4,846
Santa Cruz	1,905	21		1,926
Shasta	1,051	9	23	1,083
Sierra	895	5		900
Siskiyou	1,118	15	3	1,136
Solano	3,009	26		3,035
Sonoma	4,752	18	5	4,775
Stanislaus	1,514			1,514
Sutter	1,213			1,213
Tehama	944	36	3	983
Trinity	397	3	11	411
Tulare	1,517	5	1	1,523
Tuolumne	1,298	14	1	1,313
Ventura	619		2	621
Yolo	1,778	10	1	1,789
Yuba	1,771	48	6	1,825
Totals	105,107	614	169	105,890

TABLE No. 1—Continued.

COUNTIES.	Number of Children between Five and Seventeen years of age who have attended Public Schools at any time during the year 1875.			
	White.	Negro.	Indian.	Total.
Alameda	6,395	61	4	6,460
Alpine	73			73
Amador	1,918	17		1,935
Butte	2,703	14	5	2,722
Calaveras	1,690		2	1,692
Colusa	1,573	12		1,585
Contra Costa	2,217			2,217
Del Norte	329		18	347
El Dorado	1,782	23	16	1,821
Fresno	785		2	787
Humboldt	1,986	3	59	2,048
Inyo	305			305
Kern	531	2	3	536
Klamath				
Lake	1,044			1,044
Lassen	492		2	494
Los Angeles	4,142	28	6	4,176
Marin	1,117		1	1,118
Mariposa	632	17	3	652
Mendocino	1,993		47	2,040
Merced	868	9		877
Modoc	690			690
Mono	94			94
Monterey	2,089	3	2	2,094
Napa	1,988	15	3	2,006
Nevada	3,592	30	3	3,625
Placer	2,097	4		2,101
Plumas	638		2	640
Sacramento	4,283	70		4,353
San Benito	959			959
San Bernardino	1,279	4		1,283
San Diego	854		3	857
San Francisco	26,135	76		26,211
San Joaquin	4,062	29		4,091
San Luis Obispo	1,100	3		1,103
San Mateo	1,523			1,523
Santa Barbara	1,201	3	5	1,209
Santa Clara	4,869	18		4,887
Santa Cruz	2,067	22		2,089
Shasta	1,120	4	36	1,160
Sierra	898	5		903
Siskiyou	1,288	16	5	1,309
Solano	3,222	17	7	3,246
Sonoma	5,244	15	3	5,262
Stanislaus	1,652	5		1,657
Sutter	1,295	4		1,299
Tehama	968	38	1	1,007
Trinity	433	3	10	446
Tulare	1,915	15	1	1,931
Tuolumne	1,404	15	1	1,420
Ventura	693			693
Yolo	1,911	17	2	1,930
Yuba	1,845	40	4	1,889
Totals	115,983	657	256	116,896

TABLE No. 1—Continued.

COUNTIES.	Number of Children between Five and Seventeen years of age who have attended Private Schools at any time during the School Year of 1874.			
	White.	Negro.	Indian.	Total.
Alameda	690	4	....	694
Alpine	....	....	....	....
Amador	83	....	1	84
Butte	132	....	....	132
Calaveras	33	....	....	33
Colusa	91	2	....	93
Contra Costa	187	....	....	187
Del Norte	9	....	....	9
El Dorado	87	1	....	88
Fresno	32	....	....	32
Humboldt	150	....	....	150
Inyo	12	....	....	12
Kern	9	....	....	9
Klamath	....	....	....	....
Lake	34	....	....	34
Lassen	....	....	....	....
Los Angeles	538	....	....	538
Marin	346	1	1	348
Mariposa	5	....	....	5
Mendocino	66	3	9	78
Merced	23	....	....	23
Modoc	5	....	....	5
Mono	1	....	....	1
Monterey	98	....	....	98
Napa	234	....	....	234
Nevada	396	2	....	398
Placer	34	2	....	36
Plumas	18	....	....	18
Sacramento	739	1	....	740
San Benito	89	....	....	89
San Bernardino	63	....	....	63
San Diego	91	....	4	95
San Francisco	5,841	32	....	5,873
San Joaquin	175	....	....	175
San Luis Obispo	104	....	....	104
San Mateo	292	1	....	293
Santa Barbara	235	....	....	235
Santa Clara	1,015	19	1	1,035
Santa Cruz	262	4	....	266
Shasta	9	....	1	10
Sierra	12	....	....	12
Siskiyou	91	....	....	91
Solano	560	....	....	560
Sonoma	351	....	2	353
Stanislaus	31	....	....	31
Sutter	33	....	....	33
Tehama	50	....	....	50
Trinity	19	....	....	19
Tulare	65	....	....	65
Tuolumne	154	....	....	154
Ventura	50	....	....	50
Yolo	125	....	....	125
Yuba	283	6	....	289
Totals	14,052	78	19	14,149

TABLE No. 1—Continued.

COUNTIES.	Number of Children between Five and Seventeen years of age who have attended Private Schools at any time during the School Year of 1875.			
	White.	Negro.	Indian.	Total.
Alameda	633	4	....	637
Alpine	....	....	....	....
Amador	46	....	....	46
Butte	157	....	....	157
Calaveras	57	....	....	57
Colusa	127	....	....	127
Contra Costa	230	3	....	233
Del Norte	1	....	....	1
El Dorado	77	....	....	77
Fresno	63	1	....	64
Humboldt	131	....	....	131
Inyo	4	....	....	4
Kern	21	....	....	21
Lake	36	....	1	37
Lassen	16	....	1	17
Los Angeles	891	2	2	895
Marin	205	1	1	207
Mariposa	33	....	....	33
Mendocino	40	....	....	40
Merced	14	....	1	15
Modoc	7	....	....	7
Mono	2	....	....	2
Monterey	144	....	....	144
Napa	300	....	....	300
Nevada	390	....	....	390
Placer	95	....	....	95
Plumas	22	....	....	22
Sacramento	752	....	....	752
San Benito	98	....	....	98
San Bernardino	97	1	....	98
San Diego	83	....	4	87
San Francisco	6,060	34	....	6,094
San Joaquin	167	....	....	167
San Luis Obispo	107	....	....	107
San Mateo	337	....	....	337
Santa Barbara	336	....	....	336
Santa Clara	1,147	12	....	1,159
Santa Cruz	252	....	1	253
Shasta	15	....	3	18
Sierra	31	....	....	31
Siskiyou	36	....	....	36
Solano	567	....	....	567
Sonoma	373	....	1	374
Stanislaus	30	....	....	30
Sutter	22	....	....	22
Tehama	43	....	....	43
Trinity	52	1	2	55
Tulare	106	....	....	106
Tuolumne	52	....	....	52
Ventura	48	....	1	49
Yolo	102	....	....	102
Yuba	284	5	....	289
Totals	14,939	64	18	15,021

Table No. 1—Continued.

Counties.	Number of Children between Five and Seventeen years of age who have not attended School at any time during the School Year of 1874.			
	White.	Negro.	Indian.	Total.
Alameda	1,942	25	8	1,975
Alpine	6	...	...	6
Amador	384	6	5	395
Butte	612	13	33	658
Calaveras	565	4	4	573
Colusa	514	16	13	543
Contra Costa	675	5	7	687
Del Norte	100	...	23	123
El Dorado	434	10	23	467
Fresno	415	6	40	461
Humboldt	552	1	40	593
Inyo	56	2	...	58
Kern	355	1	2	358
Klamath	99	...	...	99
Lake	277	1	7	285
Lassen	164	...	2	166
Los Angeles	3,079	30	58	3,167
Marin	278	...	2	280
Mariposa	289	5	19	313
Mendocino	528	1	121	650
Merced	244	...	...	244
Modoc	309	...	8	317
Mono	17	...	1	18
Monterey	1,031	8	8	1,047
Napa	546	3	10	559
Nevada	843	9	2	854
Placer	448	1	7	456
Plumas	190	...	...	190
Sacramento	1,212	27	7	1,246
San Benito	388	...	...	388
San Bernardino	653	5	12	670
San Diego	754	11	37	802
San Francisco	8,528	61	9	8,598
San Joaquin	953	17	...	970
San Luis Obispo	812	...	1	813
San Mateo	487	1	2	490
Santa Barbara	891	2	10	903
Santa Clara	1,826	11	6	1,843
Santa Cruz	807	6	3	816
Shasta	284	...	96	380
Sierra	177	2	...	179
Siskiyou	334	4	32	370
Solano	818	4	13	835
Sonoma	1,345	4	49	1,398
Stanislaus	281	9	...	290
Sutter	227	1	4	232
Tehama	334	5	9	348
Trinity	135	3	28	166
Tulare	567	7	15	589
Tuolumne	463	10	5	478
Ventura	342	...	13	355
Yolo	478	4	8	490
Yuba	466	12	9	487
Totals	38,514	353	811	39,678

Table No. 1—Continued.

Counties.	Number of Children between Five and Seventeen years of age who have not attended School at any time during the School Year of 1875.			
	White.	Negro.	Indian.	Total.
Alameda	2,199	27	7	2,233
Alpine	12	...	...	12
Amador	393	7	...	400
Butte	555	14	36	605
Calaveras	453	3	11	467
Colusa	612	7	15	634
Contra Costa	589	5	3	597
Del Norte	78	3	19	100
El Dorado	410	7	20	437
Fresno	519	9	19	547
Humboldt	609	1	74	684
Inyo	83	2	3	88
Kern	435	3	2	440
Lake	270	1	17	288
Lassen	154	...	2	156
Los Angeles	2,650	13	53	2,716
Marin	313	6	3	322
Mariposa	212	5	28	245
Mendocino	607	3	118	728
Merced	272	6	1	279
Modoc	148	...	1	149
Mono	15	...	1	16
Monterey	1,033	12	3	1,048
Napa	501	10	5	516
Nevada	686	3	1	690
Placer	314	3	6	323
Plumas	159	...	13	172
Sacramento	1,354	15	8	1,377
San Benito	398	1	...	399
San Bernardino	579	1	10	590
San Diego	829	13	48	890
San Francisco	8,663	53	...	8,716
San Joaquin	941	13	...	954
San Luis Obispo	796	...	6	802
San Mateo	478	2	...	480
Santa Barbara	734	3	...	737
Santa Clara	2,332	22	10	2,364
Santa Cruz	861	7	2	870
Shasta	243	3	93	339
Sierra	178	1	2	181
Siskiyou	292	6	62	360
Solano	797	9	11	817
Sonoma	1,302	4	61	1,367
Stanislaus	218	4	...	222
Sutter	221	5	2	228
Tehama	356	5	14	375
Trinity	124	...	17	141
Tulare	784	6	10	800
Tuolumne	388	5	7	400
Ventura	380	...	...	380
Yolo	521	5	8	534
Yuba	411	13	7	431
Totals	38,461	346	839	39,646

Table No. 1—Continued.

Counties.	Number Mongolian Children under Seventeen Years of Age.		Number Mongolian Children, between Five and Seventeen Years of Age, attending School.	
	1874.	1875.	1874.	1875.
Alameda	246	251	8	92
Alpine				
Amador	6	10	1	
Butte	10	37	1	9
Calaveras	15	13		
Colusa		10		
Contra Costa	2	5		
Del Norte	1	1		
El Dorado	32	23	2	8
Fresno		1		
Humboldt	4	7	1	1
Inyo		2		
Kern	3	6		
Lake				
Lassen				
Los Angeles	25	891	11	64
Marin	38	4		3
Mariposa	11	8	1	2
Mendocino		8		
Merced	1	20		
Modoc				
Mono		1		
Monterey	8	28		1
Napa	6	14		
Nevada	19	9	1	1
Placer	20	34		4
Plumas	10	5		
Sacramento	128	18	101	
San Benito	4			
San Bernardino		3		
San Diego	15	3		
San Francisco	1,286	855	308	61
San Joaquin	26	25	1	2
San Luis Obispo		1	1	
San Mateo	2	1		
Santa Barbara	20	12	7	
Santa Clara	50	138	18	88
Santa Cruz	4			2
Shasta	5	3		
Sierra	10	8	2	
Siskiyou	14	10	1	
Solano	20	3	1	1
Sonoma	32	9		11
Stanislaus		1		1
Sutter	1			1
Tehama	4	2		
Trinity	2	13		2
Tulare				
Tuolumne	16	5	1	
Ventura	2		1	
Yolo	5	7	3	
Yuba	28	27		
Totals	2,131	2,532	471	354

Table No. 1—Continued.

Counties.	Number of Deaf and Dumb Children between Five and Twenty-one Years of Age.		Number of Blind Children, between Five and Twenty-one Y'rs of Age.	
	1874.	1875.	1874.	1875.
Alameda	6	5	8	3
Alpine				
Amador	1	1		
Butte	2			
Calaveras	1	1		
Colusa				1
Contra Costa	1		1	
Del Norte	1		2	1
El Dorado				
Fresno		1		
Humboldt	1	1	1	2
Inyo				
Kern		1		
Lake	2			
Lassen				
Los Angeles	4	6	1	
Marin				
Mariposa	1		1	
Mendocino	1		2	
Merced				
Modoc	3			
Mono				
Monterey		2		2
Napa	2	3		
Nevada	2	1		1
Placer				1
Plumas	1	1		
Sacramento	2	3	1	1
San Benito	1	2		
San Bernardino		1	1	
San Diego				
San Francisco	20	7	5	1
San Joaquin		3		1
San Luis Obispo	1			1
San Mateo				
Santa Barbara	2	1		
Santa Clara	1	4	1	1
Santa Cruz		3		
Shasta	2	2		
Sierra	1	1		
Siskiyou	1			
Solano	1		1	4
Sonoma	2	3	1	
Stanislaus	1			1
Sutter	1			
Tehama				
Trinity	1			
Tulare				
Tuolumne				
Ventura	1			
Yolo	2			
Yuba	2			
Totals	71	53	26	21

TABLE No. 1—Continued.

COUNTIES.	Nativity of Children. 1874. Native born, native parents.	Native born, one parent Foreign.	Native born, both parents Foreign.	Foreign born.
Alameda	5,277	1,200	5,619	331
Alpine*	....	....	....	....
Amador	1,632	385	1,227	83
Butte	3,094	456	795	90
Calaveras	1,104	399	1,542	32
Colusa	2,633	223	252	44
Contra Costa	1,637	420	1,975	107
Del Norte	392	70	142	8
El Dorado	1,536	630	1,174	8
Fresno	1,517	78	126	16
Humboldt	2,342	332	747	98
Inyo	289	43	195	7
Kern	834	54	247	2
Klamath	290	36	89	3
Lake	1,525	122	144	16
Lassen	573	64	23	....
Los Angeles	7,049	1,178	1,477	108
Marin	914	417	1,029	104
Mariposa	578	113	539	10
Mendocino	3,169	224	454	65
Merced	1,352	122	279	1
Modoc	1,223	52	51	....
Mono	128	3	35	....
Monterey	2,763	584	788	62
Napa	2,386	453	834	105
Nevada	2,659	967	2,652	106
Placer	1,685	416	1,267	42
Plumas	727	155	322	11
Sacramento	4,023	1,080	3,523	90
San Benito	1,489	191	338	37
San Bernardino	2,011	253	322	21
San Diego	1,519	309	479	91
San Francisco	12,240	5,956	40,056	2,299
San Joaquin	4,264	799	1,995	52
San Luis Obispo	2,074	324	246	50
San Mateo	1,275	452	1,339	105
Santa Barbara	2,332	263	172	31
Santa Clara	5,591	1,244	4,263	125
Santa Cruz	2,533	591	1,189	94
Shasta	1,413	265	360	5
Sierra	226	146	489	39
Siskiyou	1,390	373	503	1
Solano	3,299	732	2,411	69
Sonoma*	....	....	....	....
Stanislaus	1,951	419	291	6
Sutter	1,578	233	366	33
Tehama	1,522	132	194	18
Trinity*	....	....	....	....
Tulare	2,719	169	221	25
Tuolumne	1,302	222	990	35
Ventura	1,222	169	126	25
Yolo	2,563	220	727	42
Yuba	1,898	469	1,263	45
Totals	109,742	24,207	85,887	4,797

* Superintendent failed to report.

TABLE No. 1—Continued.

COUNTIES.	Nativity of Children. 1875. Native born, native parents.	Native born, one parent Foreign.	Native born, both parents Foreign.	Foreign born.
Alameda	6,020	1,318	6,172	715
Alpine*	....	....	....	....
Amador	1,805	310	1,273	31
Butte	3,593	431	985	38
Calaveras	1,192	275	1,429	37
Colusa	3,037	218	218	73
Contra Costa	1,697	458	2,133	146
Del Norte	400	66	148	....
El Dorado	1,584	518	1,112	15
Fresno	1,591	168	262	60
Humboldt	2,750	452	966	99
Inyo	280	58	257	....
Kern	1,177	86	204	29
Lake	1,699	120	187	13
Lassen	823	93	57	13
Los Angeles	7,284	1,281	1,304	190
Marin	919	348	1,090	55
Mariposa	594	188	476	13
Mendocino	3,276	262	526	132
Merced	1,303	177	254	35
Modoc	1,035	56	52	13
Mono	128	16	34	....
Monterey	3,113	727	869	47
Napa	2,382	506	1,109	142
Nevada	2,252	985	3,122	238
Placer	1,789	545	1,203	40
Plumas	809	129	306	12
Sacramento	4,014	513	3,743	136
San Benito	1,608	220	363	35
San Bernardino	2,242	185	334	14
San Diego	1,648	349	480	23
San Francisco	13,319	6,282	42,886	2,413
San Joaquin	4,696	756	1,789	127
San Luis Obispo	2,410	243	301	32
San Mateo	1,385	418	1,503	168
Santa Barbara	2,908	219	222	30
Santa Clara	5,830	1,577	4,193	509
Santa Cruz	2,732	686	1,169	52
Shasta	1,503	238	339	9
Sierra	427	123	449	12
Siskiyou	1,468	287	661	12
Solano	3,289	646	2,630	155
Sonoma	6,904	1,042	1,791	245
Stanislaus	1,934	257	429	26
Sutter	1,671	192	370	29
Tehama	1,706	143	211	20
Trinity	497	218	493	17
Tulare	3,727	214	227	36
Tuolumne	731	1,389	1,276	11
Ventura	1,349	169	123	15
Yolo	2,683	248	807	59
Yuba	1,906	534	1,239	73
Totals	125,119	26,962	93,776	6,444

* Superintendent failed to report.

TABLE No. 2.

School Statistics.

COUNTIES.	Whole Number of Boys Enrolled.		Whole Number of Girls Enrolled.		Total Number Enrolled.	
	1874.	1875.	1874.	1875.	1874.	1875.
Alameda	2,869	3,195	2,720	3,066	5,589	6,261
Alpine	48	36	40	33	88	69
Amador	933	1,060	901	1,009	1,834	2,069
Butte	1,278	1,361	1,193	1,281	2,471	2,642
Calaveras	911	869	857	833	1,768	1,702
Colusa	828	968	725	8[illegible]9	1,553	1,787
Contra Costa	1,163	1,282	1,007	1,157	2,170	2,439
Del Norte	156	201	158	186	314	387
El Dorado	1,018	1,048	953	947	1,971	1,995
Fresno	390	521	309	418	699	939
Humboldt	1,033	1,264	871	1,056	1,904	2,320
Inyo	142	141	122	142	264	283
Kern	211	255	206	288	417	543
Klamath	78	......	72	......	150	......
Lake	478	596	456	614	934	1,210
Lassen	275	266	279	278	554	544
Los Angeles	2,075	2,285	1,691	1,952	3,766	4,237
Marin	528	542	518	531	1,046	1,073
Mariposa	365	341	345	366	710	707
Mendocino	1,170	1,196	1,096	1,203	2,266	2,399
Merced	528	576	490	543	1,018	1,119
Modoc	358	375	308	229	666	604
Mono	56	66	29	36	85	102
Monterey	1,625	1,254	1,322	1,161	2,947	2,415
Napa	1,045	1,096	966	1,015	2,011	2,111
Nevada	1,852	1,969	1,689	1,805	3,541	3,774
Placer	1,030	1,203	914	1,059	1,944	2,262
Plumas	346	391	330	347	676	738
Sacramento	2,402	2,384	2,251	2,401	4,653	4,785
San Benito	......	568	......	469	......	1,037
San Bernardino	622	705	536	670	1,158	1,375
San Diego	374	419	330	399	704	818
San Francisco	16,237	16,937	14,622	15,138	30,859	32,075
San Joaquin	2,755	2,828	2,754	2,792	5,509	5,620
San Luis Obispo	515	636	459	498	974	1,134
San Mateo	764	789	619	650	1,383	1,439
Santa Barbara	563	690	427	539	990	1,229
Santa Clara	3,039	3,009	2,682	2,777	5,721	5,786
Santa Cruz	1,202	1,279	1,009	1,147	2,211	2,426
Shasta	595	633	566	572	1,161	1,205
Sierra	454	486	503	483	957	969
Siskiyou	569	709	526	678	1,095	1,387
Solano	1,652	2,032	1,388	1,562	3,040	3,594
Sonoma	2,438	3,080	2,273	2,820	4,711	5,900
Stanislaus	895	956	783	857	1,678	1,813
Sutter	690	722	643	701	1,333	1,423
Tehama	529	544	493	563	1,022	1,107
Trinity	187	233	168	210	355	443
Tulare	625	992	626	1,000	1,251	1,992
Tuolumne	709	844	634	733	1,343	1,577
Ventura	333	421	341	421	674	842
Yolo	1,078	1,136	966	1,020	2,044	2,156
Yuba	1,122	1,104	936	963	2,058	2,067
Totals	63,138	68,493	57,102	62,437	120,240	130,930

Table No. 2—Continued.

COUNTIES.	Average Number Belonging.		Average Daily Attendance.		Percentage of Attendance on Average Number Belonging.	
	1874.	1875.	1874.	1875.	1874.	1875.
Alameda	4,181	4,852	3,859	4,458	92.3	91.88
Alpine	12	50	11	42	85.	84.
Amador	1,232	1,562	1,089	1,382	88.50	88.47
Butte	1,703	1,731	1,500	1,537	88.	88.80
Calaveras	1,137	1,181	1,018	1,054	89.	89.24
Colusa	998	1,119	837	963	83.	86.06
Contra Costa	1,299	1,529	1,140	1,357	88.	88.70
Del Norte	230	265	202	232	87.89	87.50
El Dorado	1,340	1,404	1,211	1,248	90.	88.89
Fresno	499	518	431	457	86.2	88.23
Humboldt	1,115	1,415	990	1,248	89.75	88.19
Inyo	165	183	144	159	87.	86.90
Kern	306	364	267	328	87.	90.10
Klamath	124	......	115	......	92.74	......
Lake	656	739	527	637	80.	86.19
Lassen	381	424	350	390	91.	91.82
Los Angeles	2,086	2,307	1,874	2,049	90.	88.80
Marin	736	730	676	642	92.	88.01
Mariposa	470	412	435	360	91.15	89.80
Mendocino	1,328	1,409	1,177	1,243	88.	88.24
Merced	553	583	491	527	89.	90.15
Modoc	468	508	399	441	81.	86.81
Mono	64	64	60	57	93.	88.13
Monterey	1,732	1,528	1,571	1,356	89.	88.78
Napa	1,282	1,426	1,256	1,251	88.	87.72
Nevada	2,451	2,649	2,150	2,356	88.	88.93
Placer	1,357	1,604	1,192	1,338	86.	83.41
Plumas	455	484	415	431	91.	89.15
Sacramento	3,513	3,185	3,162	2,695	87.	84.61
San Benito	......	675	......	592	......	87.70
San Bernardino	607	785	515	675	85.	86.02
San Diego	536	504	481	440	90.	87.30
San Francisco	20,982	22,151	19,434	20,830	93.	94.03
San Joaquin	3,285	3,243	2,961	2,897	90.	89.32
San Luis Obispo	670	744	602	679	89.	91.26
San Mateo	839	914	747	815	89.	89.14
Santa Barbara	514	677	449	608	87.	89.80
Santa Clara	3,566	3,795	3,231	3,480	89.	93.54
Santa Cruz	1,374	1,525	1,237	1,367	90.	89.63
Shasta	811	807	710	694	88.	86.00
Sierra	742	715	645	649	86.	90.76
Siskiyou	896	1,000	806	906	90.	90.53
Solano	2,214	2,475	2,020	2,229	93.	90.34
Sonoma	3,193	3,770	2,936	3,437	91.95	91.17
Stanislaus	1,080	1,162	954	1,016	88.	87.44
Sutter	968	926	848	710	87.	76.67
Tehama	650	699	580	603	89.	86.26
Trinity	281	345	261	316	92.88	91.59
Tulare	867	1,124	776	956	91.	85.05
Tuolumne	970	1,187	857	1,058	88.	89.13
Ventura	388	443	340	388	87.	87.58
Yolo	1,308	1,418	1,164	1,273	89.	89.77
Yuba	1,193	1,328	1,180	1,171	86.	88.18
Totals	79,807	86,637	72,283	78,027	90.57	90.06
					Average.	

TABLE No. 2—Continued.

*Classification of public school pupils.**

COUNTIES.	1874.									
	High School.	First grade.†		Second grade.‡		Third grade.§				Total.
		1st Div.	2d Div.	1st Div.	2d Div.	1st Div.	2d Div.	3d Div.	4th Div.	
Alameda	187	315	403	582	682	760	857	841	962	5,589
Alpine (not reported)	......	......	......	......	......	......	......	......	......	......
Amador	6	51	58	220	240	252	296	236	345	1,704
Butte	100	88	129	315	377	314	401	397	350	2,471
Calaveras	3	38	67	227	286	260	342	281	264	1,768
Colusa	8	61	83	223	208	285	240	218	225	1,551
Contra Costa	49	79	120	171	241	270	310	240	255	1,735
Del Norte	13	7	29	39	59	39	50	48	30	314
El Dorado	31	80	220	283	375	69	355	275	283	1,971
Fresno	12	34	54	97	89	84	117	98	139	724
Humboldt	23	98	120	218	289	330	271	223	332	1,904
Inyo	2	19	6	43	33	29	23	56	53	264
Kern	3	32	38	66	54	70	51	52	47	413
Lake	18	61	76	90	145	186	103	75	174	928
Lassen	......	......	......	12	41	30	101	141	229	554
Los Angeles	50	170	233	385	554	46	570	585	1,141	3,734
Marin	2	82	92	119	122	95	187	192	165	1,056
Mariposa	......	15	24	95	97	128	120	119	112	710
Mendocino	40	77	141	271	369	324	326	295	423	2,266
Merced	18	48	106	157	135	152	124	118	150	1,008
Modoc	16	15	25	82	96	59	100	72	103	568
Mono	......	......	......	......	......	......	23	35	27	85
Monterey	76	145	208	315	491	332	521	380	495	2,963
Napa	34	96	130	235	261	250	278	240	490	2,014
Nevada	127	162	358	474	597	480	579	366	398	3,541
Placer	20	149	192	313	339	309	244	219	159	1,944
Plumas	2	15	69	71	105	108	100	75	131	676
Sacramento	87	393	588	703	738	376	802	719	257	4,663
San Benito	......	......	......	......	......	......	......	......	......	......
San Bernardino	......	86	54	168	212	118	186	145	189	1,158
San Diego	......	36	51	45	80	82	138	98	115	645
San Francisco	659	891	1,066	1,638	1,956	3,234	3,660	3,917	6,493	23,514
San Joaquin	100	459	483	711	464	489	942	832	1,033	5,513
San Luis Obispo	......	34	45	140	115	109	163	187	181	974
San Mateo	20	68	103	158	178	193	218	210	235	1,383
Santa Barbara	27	36	33	113	112	149	168	134	218	990
Santa Clara	187	244	294	477	610	676	1,026	1,093	1,114	5,721
Santa Cruz	91	112	147	217	230	341	354	349	370	2,211
Shasta	28	90	98	125	164	102	185	176	193	1,161
Sierra	......	31	62	111	124	103	156	219	151	957
Siskiyou	23	92	95	144	181	137	146	161	116	1,095
Solano	54	134	280	399	476	361	365	485	486	3,040
Sonoma	5	102	165	244	336	340	329	281	322	2,124
Stanislaus	49	154	170	295	253	157	251	234	115	1,678
Sutter	......	37	70	195	160	57	127	140	183	969
Tehama	......	32	54	123	155	101	164	217	176	1,022
Trinity (not reported)	......	......	......	......	......	......	......	......	......	......
Tulare	66	60	54	72	86	78	82	70	81	649
Tuolumne	125	57	68	173	177	138	196	180	229	1,343
Ventura	8	25	61	63	137	71	135	67	107	674
Yolo	44	102	152	215	327	316	291	298	299	2,044
Yuba	34	82	177	221	266	......	394	384	514	2,072
Totals	2,447	5,294	7,351	11,853	13,822	12,989	17,167	16,473	20,659	108,055

* See page 4* of the Appendix for the studies pursued by the pupils of the several divisions of the different grades.
† Or Grammar Schools.
‡ Or Intermediate Schools.
§ Or Primary Schools.

Table No. 2—Continued.

*Classification of public school pupils.**

COUNTIES.	1875.									
	High School.	First grade.†		Second grade.‡		Third grade.§				Total.
		1st Div.	2d Div.	1st Div.	2d Div.	1st Div.	2d Div.	3d Div.	4th Div.	
Alameda	202	495	542	682	788	822	820	877	1,033	6,261
Alpine	......	......	6	16	12	5	14	12	4	69
Amador	123	100	181	199	276	332	210	248	400	2,069
Butte	76	128	180	368	448	320	439	393	300	2,652
Calaveras	30	59	117	207	285	240	296	231	237	1,702
Colusa	13	107	156	267	319	293	206	226	200	1,787
Contra Costa	50	94	224	245	318	346	377	363	422	2,439
Del Norte	10	17	40	44	45	......	76	66	89	387
El Dorado	62	125	229	263	266	188	395	246	221	1,995
Fresno	29	34	64	128	119	122	146	149	148	939
Humboldt	53	96	178	224	378	353	386	288	364	2,320
Inyo	12	26	27	38	34	39	39	32	36	283
Kern	18	39	46	78	96	28	100	83	55	543
Lake	19	66	147	141	203	181	186	136	131	1,210
Lassen	......	12	19	132	49	47	113	107	65	544
Los Angeles	113	187	310	384	600	65	627	686	1,291	4,263
Marin	......	39	100	132	152	140	159	173	178	1,073
Mariposa	33	41	48	66	70	79	78	89	97	601
Mendocino	61	154	220	308	328	332	370	333	293	2,399
Merced	27	50	83	120	174	149	162	147	207	1,119
Modoc	......	14	21	107	123	90	139	104	97	695
Mono (not reported)	......	......	......	......	......	......	......	......	......	......
Monterey	51	78	177	376	357	423	344	302	308	2,416
Napa	67	71	176	284	291	265	349	278	310	2,091
Nevada	109	315	308	588	617	......	568	610	659	3,774
Placer	47	187	275	304	407	293	291	300	158	2,262
Plumas	2	38	87	59	102	135	129	80	77	709
Sacramento	93	177	332	510	712	581	736	518	763	4,422
San Benito	16	63	124	101	156	178	148	123	128	1,037
San Bernardino	9	41	102	183	194	199	204	210	233	1,375
San Diego	12	29	67	101	134	124	102	138	111	818
San Francisco	662	1,075	1,518	2,225	2,759	4,474	4,822	5,379	9,161	32,075
San Joaquin	380	530	737	575	673	582	625	656	825	5,583
San Luis Obispo	......	21	49	109	133	94	201	232	297	1,136
San Mateo	32	74	145	152	194	209	241	213	179	1,439
Santa Barbara	22	53	147	130	120	144	136	196	281	1,229
Santa Clara	228	325	363	480	588	691	858	1,081	1,172	5,786
Santa Cruz	87	80	153	251	332	327	350	330	513	2,423
Shasta	76	31	76	154	186	141	168	164	199	1,195
Sierra	......	49	38	159	198	116	164	126	119	969
Siskiyou	29	97	146	165	193	200	214	159	184	1,387
Solano	53	245	338	512	457	440	447	522	581	3,595
Sonoma	143	278	617	626	824	761	786	850	1,015	5,900
Stanislaus	12	116	147	304	345	53	291	259	286	1,813
Sutter	......	25	70	269	295	161	146	146	211	1,323
Tehama	......	58	67	171	192	104	129	162	218	1,101
Trinity	......	22	40	92	89	82	29	43	46	443
Tulare	4	18	67	202	183	234	267	288	215	1,478
Tuolumne	102	82	77	241	193	112	174	257	339	1,577
Ventura	10	57	54	135	98	64	140	148	136	842
Yolo	37	112	205	234	342	292	372	311	251	2,156
Yuba	29	134	173	249	283	213	364	330	293	2,068
Totals	3,243	6,364	9,813	14,090	16,730	15,863	19,133	19,400	25,136	129,772

* See page 4* of the Appendix for the studies pursued by the pupils of the several divisions of the different grades.
† Or Grammar Schools.
‡ Or Intermediate Schools.
§ Or Primary Schools.

TABLE No. 2—Continued.

COUNTIES.	Total Number of School Districts.		Number of New Districts Organized.	
	1874.	1875.	1874.	1875.
Alameda	37	37	....	4
Alpine	5	5	1	....
Amador	29	31	1	1
Butte	50	50	4	5
Calaveras	31	33	....	3
Colusa	43	45	5	3
Contra Costa	35	36	....	1
Del Norte	8	8	1	....
El Dorado	39	40	1	....
Fresno	25	28	3	10
Humboldt	31	35	4	5
Inyo	8	9	1	1
Kern	9	9	1	3
Klamath	....	....	....	....
Lake	21	25	....	4
Lassen	11	12	1	2
Los Angeles	43	45	5	5
Marin	25	26	....	1
Mariposa	14	14	....	4
Mendocino	42	44	1	3
Merced	20	22	1	3
Modoc	23	22	....	....
Mono	4	4	....	....
Monterey	43	32	3	5
Napa	37	42	....	5
Nevada	40	40	....	2
Placer	45	44	2	....
Plumas	24	23	1	1
Sacramento	57	56	1	1
San Benito	....	15	....	4
San Bernardino	20	20	1	1
San Diego	21	21	....	3
San Francisco	12	12	....	....
San Joaquin	72	72	1	1
San Luis Obispo	24	24	3	2
San Mateo	24	24	4	3
Santa Barbara	8	12	5	2
Santa Clara	52	52	....	1
Santa Cruz	28	28	1	2
Shasta	25	25	....	6
Sierra	23	23	....	2
Siskiyou	34	34	3	1
Solano	43	43	2	4
Sonoma	87	92	3	5
Stanislaus	41	42	5	5
Sutter	37	36	1	....
Tehama	21	24	5	4
Trinity	10	11	1	4
Tulare	29	44	8	17
Tuolumne	19	22	3	2
Ventura	11	12	1	1
Yolo	41	41	....	2
Yuba	31	33	1	1
Totals	1,512	1,579	85	145

TABLE No. 2—Continued.

COUNTIES.	Number of First Grade Schools.		Number of Second Grade Schools.		Number of Third Grade Schools.	
	1874.	1875.	1874.	1875.	1874.	1875.
Alameda	54	55	26	32	30	34
Alpine	1	....	1	2	3	3
Amador	10	9	17	17	9	14
Butte	11	13	31	27	17	22
Calaveras	14	17	10	12	10	9
Colusa	16	23	19	21	8	6
Contra Costa	28	24	7	16	9	7
Del Norte	2	2	7	4	1	4
El Dorado	23	35	16	7	4	2
Fresno	3	13	17	10	6	9
Humboldt	14	15	22	28	6	7
Inyo	6	7	2	1	....	1
Kern	5	4	3	6	4	4
Klamath	....	....	....	....	....	....
Lake	13	18	3	7	6	3
Lassen	....	2	1	6	11	6
Los Angeles	21	29	25	30	15	13
Marin	10	11	10	11	8	7
Mariposa	....	5	14	9	2	3
Mendocino	19	23	22	22	8	7
Merced	16	11	6	13	2	2
Modoc	4	4	8	8	11	10
Mono	....	....	....	4	4	....
Monterey	13	7	22	20	19	17
Napa	14	19	21	19	13	6
Nevada	26	24	20	24	13	18
Placer	29	30	16	15	8	8
Plumas	14	14	7	5	1	4
Sacramento	42	56	24	28	10	22
San Benito	....	8	....	3	....	8
San Bernardino	6	7	14	14	2	1
San Diego	5	9	9	10	13	2
San Francisco	14	14	10	11	27	26
San Joaquin	69	88	17	11	13	....
San Luis Obispo	4	4	11	16	12	9
San Mateo	13	20	12	13	8	4
Santa Barbara	6	9	6	6	3	7
Santa Clara	32	42	35	22	29	43
Santa Cruz	7	10	12	16	27	20
Shasta	8	9	12	13	14	9
Sierra	9	4	9	14	6	6
Siskiyou	14	13	13	18	9	8
Solano	23	29	25	27	23	18
Sonoma	34	56	49	32	34	45
Stanislaus	10	16	21	22	13	7
Sutter	5	6	20	23	13	9
Tehama	3	3	10	7	14	19
Trinity	3	1	5	8	4	4
Tulare	1	4	16	25	12	17
Tuolumne	4	10	11	10	9	8
Ventura	6	3	6	9	2	4
Yolo	23	27	18	13	9	11
Yuba	11	13	19	23	15	12
Totals	718	875	737	770	50	545

TABLE No. 2—Continued.

COUNTIES.	Total Number of Schools.		Number of New School Houses Erected.	
	1874.	1875.	1874.	1875.
Alameda	110	121	2	6
Alpine	5	5	......	......
Amador	36	40	1	3
Butte	59	62	4	4
Calaveras	34	38	3	3
Colusa	43	50	2	7
Contra Costa	44	47	......	1
Del Norte	10	10	1	1
El Dorado	43	44	2	2
Fresno	26	32	6	6
Humboldt	42	50	5	5
Inyo	8	9	2	......
Kern	12	14	2	......
Klamath	......	......	......	......
Lake	22	28	1	5
Lassen	12	14	1	2
Los Angeles	61	72	8	9
Marin	28	29	......	4
Mariposa	16	17	......	4
Mendocino	49	52	2	......
Merced	24	26	......	2
Modoc	23	22	2	2
Mono	4	4	......	......
Monterey	54	44	4	5
Napa	48	44	2	4
Nevada	59	66	4	5
Placer	53	53	3	3
Plumas	22	23	......	1
Sacramento	76	106	2	2
San Benito	......	19	......	5
San Bernardino	22	22	......	3
San Diego	27	21	......	......
San Francisco	51	51	......	5
San Joaquin	99	99	1	4
San Luis Obispo	27	29	4	1
San Mateo	33	37	2	4
Santa Barbara	15	22	2	7
Santa Clara	96	107	2	2
Santa Cruz	46	46	2	2
Shasta	34	31	2	4
Sierra	24	24	......	1
Siskiyou	36	39	......	3
Solano	71	74	2	5
Sonoma	117	133	6	5
Stanislaus	44	45	6	5
Sutter	38	38	1	1
Tehama	27	29	3	3
Trinity	12	13	1	1
Tulare	29	46	......	19
Tuolumne	24	28	1	......
Ventura	14	16	......	2
Yolo	50	51	4	4
Yuba	45	48	1	3
Totals	2,005	2,190	99	175

TABLE No. 2—Continued.

COUNTIES.	Districts having suitable accommodations for all Pupils who may wish to attend School.		Districts not having suitable accommodations for all Pupils who may wish to attend School.	
	1874.	1875.	1874.	1875.
Alameda	24	22	13	15
Alpine	5	4	......	......
Amador	22	21	7	9
Butte	40	45	9	5
Calaveras	29	33	1	......
Colusa	20	27	18	17
Contra Costa	26	28	9	8
Del Norte	5	8	3	......
El Dorado	35	37	4	3
Fresno	16	25	7	5
Humboldt	18	30	11	5
Inyo	6	5	2	4
Kern	7	8	2	3
Lake	14	17	7	8
Lassen	10	11	1	2
Los Angeles	25	30	16	15
Marin	18	19	7	6
Mariposa	14	14	......	......
Mendocino	33	35	9	9
Merced	14	19	5	3
Modoc	7	12	15	9
Mono	3	1	1	3
Monterey	23	13	18	19
Napa	34	41	3	......
Nevada	28	32	12	8
Placer	38	39	7	5
Plumas	12	9	11	14
Sacramento	54	52	21	2
San Benito	......	10	......	7
San Bernardino	9	8	10	12
San Diego	14	12	6	9
San Francisco	51	51	......	......
San Joaquin	67	72	4	1
San Luis Obispo	15	17	9	9
San Mateo	22	25	1	2
Santa Barbara	1	5	7	7
Santa Clara	30	40	22	13
Santa Cruz	21	24	6	6
Shasta	19	23	6	5
Sierra	16	19	7	5
Siskiyou	22	28	9	7
Solano	34	39	7	8
Sonoma	72	83	8	9
Stanislaus	29	36	8	7
Sutter	27	28	9	8
Tehama	18	21	3	3
Trinity	10	10	......	......
Tulare	10	31	18	13
Tuolumne	19	20	No	report.
Ventura	9	12	2	......
Yolo	36	34	5	9
Yuba	15	35	16	7
Totals	1,146	1,320	382	324

TABLE No. 2—Continued.

COUNTIES.	Districts whose Schools are provided with water-closets.		Districts whose Schools are not provided with water-closets.	
	1874.	1875.	1874.	1875.
Alameda	36	33	1	4
Alpine	5	4		
Amador	23	18	6	12
Butte	41	47	8	3
Calaveras	30	33		
Colusa	29	33	9	11
Contra Costa	34	36	1	
Del Norte	4	5	4	3
El Dorado	33	35	6	5
Fresno	22	22	1	8
Humboldt	12	20	17	15
Inyo	4	5	4	4
Kern	4	7	5	4
Lake	9	12	12	13
Lassen	11	11		2
Los Angeles	30	34	11	11
Marin	25	25		
Mariposa	14	14		
Mendocino	33	21	19	23
Merced	17	20	2	2
Modoc	11	9	11	12
Mono	3	3	1	1
Monterey	25	19	16	13
Napa	27	41	10	
Nevada	35	38	5	2
Placer	45	44		
Plumas	19	18	4	5
Sacramento	62	53	13	1
San Benito		11		6
San Bernardino	11	14	8	6
San Diego	7	12	13	9
San Francisco	51	51		
San Joaquin	68	65	3	8
San Luis Obispo	11	13	13	13
San Mateo	21	26	2	1
Santa Barbara	8	12		
Santa Clara	41	53	11	
Santa Cruz	22	23	5	7
Shasta	8	16	17	12
Sierra	20	19	3	5
Siskiyou	21	24	10	11
Solano	31	39	10	8
Sonoma	68	77	12	15
Stanislaus	37	39		4
Sutter	28	34	8	2
Tehama	15	7	6	17
Trinity	10	10		
Tulare	15	14	13	30
Tuolumne	19	No report.		No report.
Ventura	9	9	2	3
Yolo	33	36	8	7
Yuba	20	31	11	11
Totals	1,217	1,295	321	329

TABLE No. 2—Continued.

COUNTIES.	Districts whose Schools have sufficient Grounds.		Districts whose Schools have not sufficient Grounds.	
	1874.	1875.	1874.	1875.
Alameda	32	31	5	6
Alpine	5	4		
Amador	24	28	5	2
Butte	45	49	4	1
Calaveras	29	33	1	
Colusa	31	39	7	5
Contra Costa	29	35	6	1
Del Norte	7	8	1	
El Dorado	37	39	2	1
Fresno	22	30	1	
Humboldt	21	28	8	7
Inyo	8	9		
Kern	8	8	1	3
Lake	19	20	2	5
Lassen	11	13		
Los Angeles	37	41	4	4
Marin	22	20	3	5
Mariposa	14	14		
Mendocino	35	36	7	8
Merced	17	20	2	
Modoc	18	20	4	1
Mono	3	3	1	
Monterey	37	27	4	5
Napa	37	41		
Nevada	36	35	4	5
Placer	44	41	1	3
Plumas	20	22	3	1
Sacramento	50	54	25	
San Benito		16		1
San Bernardino	19	19		1
San Diego	18	21	2	
San Francisco	51	51		
San Joaquin	71	73		
San Luis Obispo	24	25		1
San Mateo	16	27	7	
Santa Barbara	8	12		
Santa Clara	32	53	20	
Santa Cruz	23	25	4	5
Shasta	25	27		1
Sierra	19	18	4	6
Siskiyou	28	34	3	1
Solano	39	34	2	13
Sonoma	80	91		1
Stanislaus	36	42	1	1
Sutter	28	31	8	5
Tehama	19	22	2	2
Trinity	10	10		
Tulare	26	40	2	4
Tuolumne	19	No report.		No report.
Ventura	11	12		
Yolo	39	40	2	3
Yuba	31	38		4
Totals	1,370	1,509	118	112

TABLE No. 2—Continued.

COUNTIES.	DISTRICTS WHOSE SCHOOL GROUNDS ARE SUITABLY IMPROVED.		DISTRICTS WHOSE SCHOOL GROUNDS ARE NOT SUITABLY IMPROVED.	
	1874.	1875.	1874.	1875.
Alameda	21	13	16	24
Alpine	3	....	2	4
Amador	6	9	23	21
Butte	3	1	46	49
Calaveras	21	8	9	25
Colusa	16	3	22	41
Contra Costa	2	6	33	30
Del Norte	2	3	6	5
El Dorado	14	30	25	10
Fresno	....	....	23	30
Humboldt	....	6	29	29
Inyo	1	....	7	9
Kern	....	3	9	8
Lake	....	2	21	23
Lassen	2	5	9	8
Los Angeles	6	12	35	33
Marin	5	3	20	22
Mariposa	1	9	13	5
Mendocino	8	9	34	38
Merced	1	2	18	20
Modoc	1	1	21	20
Mono	....	....	4	3
Monterey	4	2	37	30
Napa	4	3	33	38
Nevada	9	13	31	27
Placer	31	4	14	40
Plumas	....	....	23	23
Sacramento	40	19	35	35
San Benito	....	12	....	5
San Bernardino	5	7	14	13
San Diego	15	20	5	1
San Francisco	51	51	....	....
San Joaquin	4	2	67	71
San Luis Obispo	1	1	23	25
San Mateo	15	3	8	24
Santa Barbara	....	....	8	12
Santa Clara	10	37	42	16
Santa Cruz	11	8	16	22
Shasta	4	12	21	16
Sierra	9	11	14	13
Siskiyou	4	2	27	33
Solano	1	7	40	40
Sonoma	1	4	79	88
Stanislaus	8	11	29	32
Sutter	9	11	27	25
Tehama	3	5	18	19
Trinity	....	7	10	3
Tulare	2	5	26	39
Tuolumne	....	No report.	19	No report.
Ventura	2	....	9	12
Yolo	4	4	37	39
Yuba	9	20	22	22
Totals	369	411	1,159	1,220

TABLE No. 2—Continued.

COUNTIES.	DISTRICTS WHOSE SCHOOLS ARE WELL VENTILATED.		DISTRICTS WHOSE SCHOOLS ARE NOT WELL VENTILATED.	
	1874.	1875.	1874.	1875.
Alameda	35	30	2	7
Alpine	5	4	....	....
Amador	29	30	....	....
Butte	48	50	1	....
Calaveras	30	33	....	....
Colusa	29	41	9	3
Contra Costa	35	36	....	....
Del Norte	5	1	3	7
El Dorado	34	40	5	....
Fresno	16	26	7	4
Humboldt	29	30	....	5
Inyo	8	9	....	....
Kern	9	10	....	1
Lake	20	24	1	1
Lassen	11	13	....	....
Los Angeles	37	41	4	4
Marin	22	25	3	....
Mariposa	14	14	....	....
Mendocino	40	44	2	....
Merced	19	22	....	....
Modoc	22	15	....	6
Mono	4	4	....	....
Monterey	37	30	4	2
Napa	37	41	....	....
Nevada	38	37	2	3
Placer	44	44	1	....
Plumas	20	16	3	7
Sacramento	66	54	9	....
San Benito	17	....	....	....
San Bernardino	19	20	....	....
San Diego	16	21	4	....
San Francisco	51	51	....	....
San Joaquin	71	73	....	....
San Luis Obispo	20	24	4	2
San Mateo	23	27	....	....
Santa Barbara	8	12	....	....
Santa Clara	52	53	....	....
Santa Cruz	26	29	1	1
Shasta	25	25	....	3
Sierra	20	24	3	....
Siskiyou	30	35	1	....
Solano	35	44	6	3
Sonoma	84	92	....	....
Stanislaus	37	42	1	1
Sutter	33	25	3	1
Tehama	19	24	2	....
Trinity	10	10	....	....
Tulare	28	44	....	....
Tuolumne	19	22	....	....
Ventura	11	12	....	....
Yolo	37	42	4	1
Yuba	30	38	1	4
Totals	1,445	1,553	86	66

TABLE No. 2—Continued.

COUNTIES.	DISTRICTS WHOSE SCHOOLS ARE SUPPLIED WITH GOOD FURNITURE.		DISTRICTS WHOSE SCHOOLS ARE SUPPLIED WITH PASSABLE FURNITURE.	
	1874.	1875.	1874.	1875.
Alameda	20	19	9	11
Alpine	......	1	5	2
Amador	3	3	3	7
Butte	16	7	5	10
Calaveras	11	22	14	9
Colusa	8	16	13	7
Contra Costa	21	21	7	6
Del Norte	2	3	2	1
El Dorado	17	19	14	9
Fresno	3	8	9	7
Humboldt	2	10	5	10
Inyo	2	1	......	1
Kern	2	4	2	3
Lake	3	6	8	9
Lassen	......	......	......	13
Los Angeles	19	20	8	13
Marin	13	15	3	3
Mariposa	2	8	5	2
Mendocino	9	9	16	23
Merced	9	14	1	......
Modoc	......	3	3	......
Mono	......	1	1	......
Monterey	10	6	4	9
Napa	17	24	......	......
Nevada	16	12	12	19
Placer	30	18	......	9
Plumas	5	4	8	8
Sacramento	47	24	11	30
San Benito	5	......	......	......
San Bernardino	4	5	5	7
San Diego	2	......	5	1
San Francisco	51	51	......	......
San Joaquin	6	19	......	54
San Luis Obispo	1	......	11	13
San Mateo	3	25	......	......
Santa Barbara	1	1	4	2
Santa Clara	30	28	17	12
Santa Cruz	17	12	1	7
Shasta	3	7	11	11
Sierra	1	4	6	8
Siskiyou	3	7	14	14
Solano	12	8	9	15
Sonoma	40	49	6	20
Stanislaus	21	28	......	1
Sutter	18	6	......	3
Tehama	6	13	2	1
Trinity	......	2	5	4
Tulare	2	7	9	7
Tuolumne	6	22	1	......
Ventura	1	3	3	1
Yolo	4	3	14	12
Yuba	12	23	1	2
Totals	531	621	292	416

TABLE No. 2—Continued.

COUNTIES.	DISTRICTS WHOSE SCHOOLS ARE SUPPLIED WITH POOR FURNITURE.		DISTRICTS WHOSE SCHOO[LS] ARE WELL SUPPLIED WIT[H] APPARATUS.	
	1874.	1875.	1874.	1875.
Alamada	8	7	1	
Alpine	......	1	......	......
Amador	23	20	2	
Butte	28	33	7	
Calaveras	5	2	7	
Colusa	17	21	7	
Contra Costa	7	9	6	
Del Norte	4	4	1	
El Dorado	8	12	7	
Fresno	11	15	......	
Humboldt	22	15	......	......
Inyo	6	7	......	......
Kern	5	4	2	
Lake	10	10	3	
Lassen	11	......	......	......
Los Angeles	14	12	7	[illegible]
Marin	9	7	4	[illegible]
Mariposa	7	4	6	
Mendocino	17	12	2	
Merced	9	8	3	
Modoc	19	18	......	......
Mono	3	3	......	......
Monterey	27	17	4	
Napa	20	17	14	[illegible]
Nevada	12	9	6	
Placer	14	17	30	[illegible]
Plumas	10	11	3	
Sacramento	8	......	24	[illegible]
San Benito	......	12	......	......
San Bernardino	10	8	......	......
San Diego	13	20	......	......
San Francisco	......	......	51	[illegible]
San Joaquin	65	......	6	[illegible]
San Luis Obispo	12	13	......	......
San Mateo	20	2	1	2
Santa Barbara	3	9	1	......
Santa Clara	5	13	10	[illegible]
Santa Cruz	9	11	3	[illegible]
Shasta	11	10	3	
Sierra	16	12	......	[illegible]
Siskiyou	14	14	1	......
Solano	20	24	7	[illegible]
Sonoma	38	23	30	[illegible]
Stanislaus	17	14	10	[illegible]
Sutter	18	27	10	......
Tehama	13	10	4	[illegible]
Trinity	5	4	......	......
Tulare	17	30	2	[illegible]
Tuolumne	12	......	3	[illegible]
Ventura	7	8	......	......
Yolo	23	28	......	[illegible]
Yuba	18	17	8	[illegible]
Totals	700	604	296	382

TABLE No. 2—Continued.

COUNTIES.	Districts whose Schools are passably supplied with Apparatus.		Districts whose Schools are poorly supplied with Apparatus.	
	1874.	1875.	1874.	1875.
Alameda	28	16	8	18
Alpine	4	2	1	2
Amador	4	5	23	21
Butte	7	10	35	34
Calaveras	15	15	8	6
Colusa	9	16	22	18
Contra Costa	17	21	12	9
Del Norte	3	6	4	1
El Dorado	16	10	16	15
Fresno	4	12	19	17
Humboldt	4	6	25	29
Inyo	1	2	7	7
Kern	2	3	5	3
Lake	4	8	14	12
Lassen	....	....	11	13
Los Angeles	8	10	26	25
Marin	10	6	11	8
Mariposa	....	1	8	4
Mendocino	15	19	25	22
Merced	1	....	15	14
Modoc	....	....	22	21
Mono	....	1	4	3
Monterey	7	6	30	18
Napa	....	....	23	25
Nevada	18	29	16	9
Placer	....	1	14	29
Plumas	8	5	12	14
Sacramento	7	28	44	15
San Benito	....	13	....	4
San Bernardino	4	5	15	15
San Diego	2	1	18	20
San Francisco	....	....	....	....
San Joaquin	....	54	65	....
San Luis Obispo	10	11	14	15
San Mateo	....	....	22	....
Santa Barbara	1	2	6	10
Santa Clara	15	23	27	18
Santa Cruz	5	7	19	10
Shasta	6	11	16	14
Sierra	7	7	16	15
Siskiyou	9	13	21	22
Solano	4	18	30	22
Sonoma	14	47	40	19
Stanislaus	8	5	20	24
Sutter	....	10	26	26
Tehama	13	3	4	11
Trinity	5	2	5	8
Tulare	6	8	20	34
Tuolumne	3	....	13	....
Ventura	....	4	11	8
Yolo	6	9	35	32
Yuba	2	10	21	24
Totals	312	501	924	763

TABLE No. 2—Continued.

COUNTIES.	Districts maintaining Schools less than six months.		Districts maintaini[…] Schools six mont[…] or over, but le[…] than eight mont[…]	
	1874.	1875.	1874.	1875.
Alameda	1	1	7	
Alpine	3	....	....	
Amador	9	8	8	
Butte	21	....	22	[illegible]
Calaveras	15	....	8	[illegible]
Colusa	11	....	10	[illegible]
Contra Costa	10	1	7	[illegible]
Del Norte	5	....	3	
El Dorado	24	1	10	[illegible]
Fresno	12	....	7	[illegible]
Humboldt	16	5	5	[illegible]
Inyo	3	....	3	
Kern	3	....	2	
Lake	13	1	6	[illegible]
Lassen	8	3	1	
Los Angeles	16	....	6	
Marin	3	2	5	
Mariposa	7	....	5	
Mendocino	17	....	12	[illegible]
Merced	2	....	8	
Modoc	20	5	2	[illegible]
Mono	....	....	3	
Monterey	14	....	15	
Napa	18	....	12	[illegible]
Nevada	4	....	12	[illegible]
Placer	13	....	14	[illegible]
Plumas	15	....	6	[illegible]
Sacramento	15	1	15	[illegible]
San Benito	....	....	....	[illegible]
San Bernardino	14	....	2	[illegible]
San Diego	6	....	7	[illegible]
San Francisco	....	....	....	....
San Joaquin	16	....	23	[illegible]
San Luis Obispo	19	....	1	[illegible]
San Mateo	5	....	6	9
Santa Barbara	1	....	2	5
Santa Clara	4	....	16	....
Santa Cruz	6	....	8	10
Shasta	16	3	6	19
Sierra	11	....	4	10
Siskiyou	25	....	6	25
Solano	10	....	14	20
Sonoma	36	....	26	40
Stanislaus	9	....	17	29
Sutter	27	....	5	27
Tehama	10	....	9	18
Trinity	5	....	3	3
Tulare	18	2	1	26
Tuolumne	4	....	9	13
Ventura	3	....	3	7
Yolo	12	....	19	23
Yuba	13	1	11	23
Totals	568	34	412	765

TABLE No. 2—Continued.

COUNTIES.	Districts maintaining Schools eight months or over.		Average number of months of all the schools in the county.	
	1874.	1875.	1874.	1875.
Alameda	29	33	8.83	9.05
Alpine	2	1	5.20	7.27
Amador	12	11	6.62	6.48
Butte	6	14	5.83	6.83
Calaveras	7	17	6.05	7.99
Colusa	17	14	6.83	7.02
Contra Costa	18	22	6.97	8.00
Del Norte	2	2	5.74	6.96
El Dorado	4	14	5.46	7.39
Fresno	6	11	6.23	7.36
Humboldt	8	14	5.46	7.14
Inyo	2	3	6.18	7.18
Kern	4	5	6.72	7.47
Lake	1	1	4.61	6.13
Lassen	2	7	5.27	7.00
Los Angeles	19	39	6.99	8 87
Marin	17	15	7.54	8.48
Mariposa	3	7	6.21	7.78
Mendocino	13	21	6.17	7.27
Merced	9	11	7.76	7.97
Modoc	1	....	4.19	5.61
Mono	1	3	7.75	8.56
Monterey	12	19	6.68	7.53
Napa	7	15	5.74	7.15
Nevada	24	37	8.01	9.12
Placer	16	25	6.47	7.58
Plumas	1	2	5.44	6.47
Sacramento	26	40	7.65	8.20
San Benito	....	5	....	7.17
San Bernardino	4	10	5.47	7.78
San Diego	7	6	6.51	7.28
San Francisco	51	51	10.00	10.00
San Joaquin	31	36	6.85	7.50
San Luis Obispo	4	5	4.66	6.83
San Mateo	12	15	6.91	8.23
Santa Barbara	5	7	7.87	7.41
Santa Clara	32	52	7.80	8.38
Santa Cruz	13	18	7.25	8.25
Shasta	3	6	5.08	6.51
Sierra	8	12	6.21	7.44
Siskiyou	....	9	4.46	6.97
Solano	17	23	6.90	7.63
Sonoma	24	47	5.97	7.73
Stanislaus	11	13	6.89	7.16
Sutter	4	9	4.94	6.83
Tehama	2	6	5.47	6.92
Trinity	2	7	5.37	7.65
Tulare	6	7	5.31	6.55
Tuolumne	6	9	6.54	7.12
Ventura	5	5	6.36	7.18
Yolo	10	18	6.31	7.42
Yuba	7	8	6.05	7.00
Totals	533	1,584	6.34	7.47

TABLE No. 2—Continued.

COUNTIES.	Number of Schools for Colored Children.		Number of Pupils attending Schools for Colored Children.		Districts which have employed the same Teacher for more than one year.	
	1874.	1875.	1874.	1875.	1874.	1875.
Alameda	....	....	....	....	15	78
Alpine	....	....	....	....	1	....
Amador	2	....	20	....	3	4
Butte	1	1	15	14	8	7
Calaveras	....	....	....	....	6	9
Colusa	1	1	3	7	7	9
Contra Costa	....	....	....	....	11	16
Del Norte	1	....	11	....	2	6
El Dorado	....	....	....	....	4	4
Fresno	....	....	....	....	2	5
Humboldt	....	....	....	....	10	8
Inyo	....	....	....	....	3	2
Kern	....	....	....	....	1	4
Lake	....	....	....	....	4	2
Lassen	....	....	....	....	1	....
Los Angeles	1	1	30	45	15	21
Marin	....	....	....	....	8	4
Mariposa	....	....	....	....	1	1
Mendocino	....	....	....	....	5	7
Merced	1	....	9	....	6	6
Modoc	....	....	....	....	1	1
Mono	....	....	....	....	1	2
Monterey	....	....	....	....	2	7
Napa	1	1	14	13	10	3
Nevada	2	2	26	25	10	19
Placer	....	....	....	....	1	40
Plumas	....	....	....	....	4	3
Sacramento	1	1	45	....	53	50
San Benito	....	....	....	....	....	2
San Bernardino	....	....	....	....	2	1
San Diego	....	....	....	....	....	....
San Francisco	2	2	105	57	....	....
San Joaquin	1	2	23	30	13	13
San Luis Obispo	....	....	....	....	4	1
San Mateo	....	....	....	....	11	5
Santa Barbara	....	....	....	....	4	5
Santa Clara	1	1	15	13	16	15
Santa Cruz	1	1	19	22	5	5
Shasta	....	....	....	....	4	....
Sierra	....	....	....	....	6	10
Siskiyou	1	1	16	18	7	6
Solano	1	....	10	....	8	10
Sonoma	1	1	16	16	16	16
Stanislaus	....	....	....	....	3	6
Sutter	....	....	....	....	4	6
Tehama	1	1	19	13	3	7
Trinity	....	....	....	....	....	....
Tulare	1	1	....	15	2	3
Tuolumne	....	....	....	....	6	6
Ventura	....	....	....	....	3	4
Yolo	1	1	10	13	10	8
Yuba	1	1	42	38	7	13
Totals	23	19	448	339	329	460

TABLE No. 2—Continued.

COUNTIES.	Districts having not Sufficient Funds for an Eight Months' School.	Number of School Visits made by County Superintendents.	
	1875.	1874.	1875.
Alameda	9	140	138
Alpine	4	3	7
Amador	21	23	25
Butte	32	89	93
Calaveras	21	33	45
Colusa	39	34	90
Contra Costa	15	104	56
Del Norte	6	11	20
El Dorado	26	42	53
Fresno	12	18	20
Humboldt	20	33	44
Inyo	9	13	16
Kern	4	3	11
Lake	22	25	122
Lassen	6	38	27
Los Angeles	26	48	162
Marin	9	46	50
Mariposa	7	20	25
Mendocino	19	55	55
Merced	13	23	59
Modoc	20	4	10
Mono	4	4	4
Monterey	13	31	54
Napa	32	62	51
Nevada	14	72	64
Placer	33	76	66
Plumas	35	28	32
Sacramento	37	242	79
San Benito	8	....	83
San Bernardino	9	11	22
San Diego	21	16	44
San Francisco	....	884	781
San Joaquin	49	91	201
San Luis Obispo	15	20	24
San Mateo	16	42	68
Santa Barbara	3	18	31
Santa Clara	No report.	78	149
Santa Cruz	13	92	63
Shasta	19	16	32
Sierra	13	17	25
Siskiyou	22	5	46
Solano	40	52	81
Sonoma	21	42	96
Stanislaus	23	29	57
Sutter	30	3	38
Tehama	8	7	28
Trinity	3	18	22
Tulare	40	2	28
Tuolumne	5	20	40
Ventura	4	13	15
Yolo	31	64	63
Yuba	25	109	106
Totals	924	2,969	3,621

TABLE No. 2—Continued.

COUNTIES.	Number of School Visits made by School Trustees.		Number of School Visits made by other persons.	
	1874.	1875.	1874.	1875.
Alameda	426	471	2,955	3,151
Alpine	9	12	44	67
Amador	67	74	814	669
Butte	242	219	1,632	1,654
Calaveras	93	121	471	839
Colusa	122	159	743	917
Contra Costa	167	129	1,089	927
Del Norte	36	51	94	186
El Dorado	156	160	751	837
Fresno	86	93	408	468
Humboldt	81	96	320	721
Inyo	17	30	173	206
Kern	27	46	257	432
Lake	80	109	308	478
Lassen	63	62	326	334
Los Angeles	254	313	1,051	1,093
Marin	84	96	382	521
Mariposa	46	28	249	145
Mendocino	125	157	758	1,212
Merced	65	94	413	327
Modoc	56	66	228	307
Mono	15	35	40	71
Monterey	207	204	777	741
Napa	130	135	817	889
Nevada	298	617	1,405	2,365
Placer	170	149	867	628
Plumas	67	116	390	530
Sacramento	239	169	1,352	751
San Benito	....	96	....	320
San Bernardino	102	74	290	191
San Diego	69	78	224	345
San Francisco	1,573	1,919	15,986	14,416
San Joaquin	386	215	1,531	1,054
San Luis Obispo	61	48	443	215
San Mateo	101	83	589	666
Santa Barbara	37	45	109	380
Santa Clara	106	273	1,030	1,814
Santa Cruz	162	179	813	1,055
Shasta	74	94	480	301
Sierra	61	55	286	314
Siskiyou	110	196	566	719
Solano	265	158	1,281	1,373
Sonoma	286	422	1,326	2,241
Stanislaus	157	196	668	888
Sutter	104	129	403	915
Tehama	105	105	412	517
Trinity	32	31	137	168
Tulare	59	124	230	439
Tuolumne	58	88	322	392
Ventura	25	30	106	149
Yolo	143	159	933	798
Yuba	150	136	834	703
Totals	7,654	8,944	48,113	51,839

TABLE No. 2—Continued.

COUNTIES.	Number of Male Teachers.		Number of Female Teachers.	
	1874.	1875.	1874.	1875.
Alameda	22	26	91	95
Alpine	3	1	2	3
Amador	21	20	14	19
Butte	34	31	26	31
Calaveras	20	21	14	17
Colusa	23	31	20	12
Contra Costa	15	21	20	48
Del Norte	4	4	6	6
El Dorado	21	22	21	22
Fresno	17	21	9	9
Humboldt	21	28	21	22
Inyo	7	4	2	5
Kern	7	10	5	4
Lake	10	12	11	15
Lassen	9	10	3	4
Los Angeles	41	42	20	30
Marin	8	9	20	19
Mariposa	12	8	5	8
Mendocino	27	25	22	27
Merced	13	11	11	15
Modoc	18	16	5	8
Mono	1	1	4	4
Monterey	29	26	23	18
Napa	19	26	35	52
Nevada	29	27	30	36
Placer	18	13	45	39
Plumas	8	3	14	20
Sacramento	27	34	79	72
San Benito	....	13	....	9
San Bernardino	16	15	6	7
San Diego	15	12	7	13
San Francisco	66	61	443	446
San Joaquin	44	49	55	44
San Luis Obispo	17	16	10	10
San Mateo	11	14	22	23
Santa Barbara	3	7	12	15
Santa Clara	19	29	39	76
Santa Cruz	13	13	33	34
Shasta	13	15	21	18
Sierra	12	12	12	13
Siskiyou	21	21	15	18
Solano	31	34	38	44
Sonoma	50	51	70	81
Stanislaus	22	26	18	20
Sutter	20	19	19	19
Tehama	11	15	15	14
Trinity	5	7	6	10
Tulare	20	31	7	11
Tuolumne	9	11	15	17
Ventura	4	8	10	8
Yolo	30	27	20	26
Yuba	21	24	24	24
Totals	957	1,033	1,495	1,660

TABLE No. 2—Continued.

COUNTIES.	Total Number of Teachers.		No. of Teachers holding 1st Grade Certificates.	
	1874.	1875.	1874.	1875.
Alameda	113	121	71	66
Alpine	5	4	1	....
Amador	35	39	15	7
Butte	60	62	34	29
Calaveras	34	38	23	25
Colusa	43	43	24	25
Contra Costa	35	69	22	45
Del Norte	10	10	2	3
El Dorado	42	44	23	22
Fresno	26	30	16	19
Humboldt	42	50	18	25
Inyo	9	9	7	7
Kern	12	14	7	6
Lake	21	27	14	19
Lassen	12	14	....	4
Los Angeles	61	72	40	39
Marin	28	28	11	16
Mariposa	17	16	4	8
Mendocino	49	52	24	30
Merced	24	26	17	17
Modoc	23	24	4	5
Mono	5	5	2	1
Monterey	52	44	30	18
Napa	54	78	28	34
Nevada	59	63	33	41
Placer	63	52	33	27
Plumas	22	23	15	14
Sacramento	106	106	79	56
San Benito	....	22	....	15
San Bernardino	22	22	7	14
San Diego	22	25	9	9
San Francisco	509	507	280	317
San Joaquin	99	93	55	87
San Luis Obispo	27	26	7	13
San Mateo	33	37	19	23
Santa Barbara	15	22	8	16
Santa Clara	58	105	25	56
Santa Cruz	46	47	15	20
Shasta	34	33	12	23
Sierra	24	25	14	14
Siskiyou	36	39	21	22
Solano	69	78	39	50
Sonoma	120	132	39	36
Stanislaus	40	46	27	26
Sutter	39	38	13	17
Tehama	26	29	6	11
Trinity	11	17	6	5
Tulare	27	42	13	14
Tuolumne	24	28	16	23
Ventura	14	16	9	10
Yolo	50	53	31	33
Yuba	45	48	19	23
Totals	2,452	2,693	1,287	1,485

TABLE No. 2—Continued.

COUNTIES.	No. of Teachers holding 2d Grade Certificates.		No. of Teachers holding 3d Grade Certificates.	
	1874.	1875.	1874.	1875.
Alameda	22	31	20	24
Alpine	4	3	....	1
Amador	13	25	7	7
Butte	20	27	6	6
Calaveras	5	10	6	3
Colusa	14	16	5	2
Contra Costa	10	16	3	8
Del Norte	5	5	3	2
El Dorado	13	15	6	7
Fresno	7	6	3	5
Humboldt	19	23	5	2
Inyo	2	1	....	1
Kern	3	5	2	3
Lake	3	4	4	4
Lassen	1	9	11	1
Los Angeles	17	26	4	7
Marin	12	10	5	2
Mariposa	12	8	1	....
Mendocino	21	19	4	3
Merced	6	9	1	....
Modoc	16	16	3	3
Mono	....	3	3	1
Monterey	18	19	4	7
Napa	20	23	6	21
Nevada	18	20	8	2
Placer	23	17	7	8
Plumas	6	5	1	4
Sacramento	25	28	2	22
San Benito	....	7	....	....
San Bernardino	13	8	2	....
San Diego	10	13	3	3
San Francisco	98	82	131	108
San Joaquin	38	5	6	1
San Luis Obispo	17	12	3	1
San Mateo	11	12	3	2
Santa Barbara	5	3	2	3
Santa Clara	23	25	10	24
Santa Cruz	16	15	15	12
Shasta	13	7	9	3
Sierra	6	7	4	4
Siskiyou	9	11	6	6
Solano	17	23	13	5
Sonoma	49	58	32	38
Stanislaus	11	18	2	2
Sutter	24	21	2	....
Tehama	11	10	9	8
Trinity	4	10	1	2
Tulare	12	23	2	5
Tuolumne	8	5	....	....
Ventura	4	4	1	2
Yolo	12	10	7	10
Yuba	17	14	9	11
Totals	763	802	402	406

TABLE No. 2—Continued.

COUNTIES.	Average Monthly Wages Paid to Male Teachers.		Average Monthly Wages Paid to Female Teachers.	
	1874.	1875.	1874.	1875.
Alameda	$114 50	$109 00	$62 00	$64 75
Alpine	80 00	94 33	65 00	62 50
Amador	78 34	79 50	59 64	60 20
Butte	71 00	74 00	52 00	65 00
Calaveras	70 50	75 00	53 00	56 00
Colusa	79 54	86 50	68 88	73 00
Contra Costa	89 46	89 44	66 87	79 00
Del Norte	74 50	91 25	44 50	63 12
El Dorado	79 15	75 00	59 70	68 13
Fresno	83 89	88 45	78 50	77 50
Humboldt	77 25	85 90	62 00	67 00
Inyo	108 16	100 00	87 50	90 25
Kern	96 50	90 00	76 00	70 00
Lake	84 37	74 50	61 21	64 00
Lassen	75 00	77 50	75 00	77 50
Los Angeles	90 00	81 77	80 00	81 77
Marin	80 62	80 73	60 75	66 16
Mariposa	86 00	96 00	66 00	62 00
Mendocino	79 51	75 11	64 72	67 69
Merced	85 00	89 79	72 40	77 45
Modoc	73 71	71 53	58 00	58 75
Mono	75 00	72 81	73 12	71 16
Monterey	84 20	87 00	72 00	67 00
Napa	80 50	80 50	63 00	63 00
Nevada	86 80	80 00	66 80	65 00
Placer	87 00	82 00	61 00	68 00
Plumas	81 00	89 00	74 00	78 00
Sacramento	81 00	75 00	71 00	70 00
San Benito	....	88 00	....	65 03
San Bernardino	63 95	75 33	46 33	69 40
San Diego	75 30	71 72	75 30	70 00
San Francisco	167 00	165 20	80 00	78 60
San Joaquin	77 70	83 00	67 56	74 00
San Luis Obispo	87 00	89 00	74 00	78 01
San Mateo	72 70	85 00	59 79	61 87
Santa Barbara	88 33	85 35	64 19	66 70
Santa Clara	91 40	95 00	68 00	65 00
Santa Cruz	84 23	90 00	53 75	60 00
Shasta	90 00	87 50	60 00	60 00
Sierra	83 75	84 16	66 33	68 00
Siskiyou	72 00	72 00	63 00	63 00
Solano	87 74	85 00	59 00	70 00
Sonoma	78 00	77 50	58 00	70 07
Stanislaus	80 14	74 97	66 18	74 91
Sutter	72 50	79 73	65 00	69 80
Tehama	85 48	82 50	65 80	66 50
Trinity	80 00	78 00	60 00	65 00
Tulare	82 77	92 00	67 28	60 00
Tuolumne	78 89	83 75	55 00	62 50
Ventura	76 87	74 40	58 50	62 50
Yolo	81 00	83 00	69 00	70 00
Yuba	86 00	83 66	69 00	62 00
Average	$83 82	$84 93	$65 20	$68 01

TABLE No. 2—Continued.

COUNTIES.	Number of Teachers who attended County Institutes.		Number of Teachers who subscribe for some Educational Journal.	
	1874.	1875.	1874.	1875.
Alameda	96	99	11	29
Alpine	....	....	....	....
Amador	16	21	....	7
Butte	30	52	45	20
Calaveras	19	13	15	12
Colusa	27	37	13	23
Contra Costa	19	42	14	15
Del Norte	1	....	5	4
El Dorado	38	38	10	19
Fresno	12	....	8	4
Humboldt	38	37	8	20
Inyo	....	....	2	5
Kern	11	1	5	6
Lake	17	25	7	12
Lassen	....	....	....	....
Los Angeles	46	64	50	25
Marin	6	27	21	11
Mariposa	....	....	14	12
Mendocino	31	48	21	19
Merced	2	20	4	15
Modoc	....	14	3	14
Mono	....	....	3	2
Monterey	24	39	11	16
Napa	37	38	1	1
Nevada	30	55	22	22
Placer	34	40	7	17
Plumas	....	12	12	17
Sacramento	86	87	17	2
San Benito	....	....	....	10
San Bernardino	20	18	10	8
San Diego	18	18	....	....
San Francisco	....	....	....	42
San Joaquin	....	90	10	20
San Luis Obispo	....	16	15	20
San Mateo	....	23	10	12
Santa Barbara	....	150	5	5
Santa Clara	....	....	12	....
Santa Cruz	41	37	8	13
Shasta	19	26	20	20
Sierra	11	....	8	....
Siskiyou	20	29	8	5
Solano	25	59	47	60
Sonoma	80	....	20	30
Stanislaus	32	31	....	10
Sutter	....	26	....	3
Tehama	24	21	9	7
Trinity	....	....	5	....
Tulare	16	32	....	....
Tuolumne	....	....	8	2
Ventura	....	13	5	8
Yolo	43	52	20	5
Yuba	....	44	35	40
Totals	969	1,494	584	669

TABLE No. 2—Continued.

COUNTIES.	Number of Teachers who are Graduates of the California State Normal School.		Number of Teachers who are Graduates of any State Normal School.	
	1874.	1875.	1874.	1875.
Alameda	13	23	22	59
Alpine	....	....	....	....
Amador	1	....	1	....
Butte	....	....	1	2
Calaveras	2	2	1	3
Colusa	2	1	8	8
Contra Costa	10	8	1	2
Del Norte	....	....	....	....
El Dorado	6	6	7	8
Fresno	....	3	....	3
Humboldt	....	....	....	3
Inyo	1	....	2	....
Kern	1	1	2	3
Lake	1	1	2	2
Lassen	1	2	....	2
Los Angeles	33	....	4	5
Marin	2	3	5	4
Mariposa	4	2	1	1
Mendocino	1	5	....	....
Merced	2	5	4	....
Modoc	....	....	....	....
Mono	....	....	....	....
Monterey	4	2	10	4
Napa	1	8	1	8
Nevada	....	2	1	4
Placer	2	4	5	3
Plumas	2	2	....	3
Sacramento	6	5	6	....
San Benito	....	5	....	....
San Bernardino	2	2	2	2
San Diego	3	....	5	2
San Francisco	64	72	91	21
San Joaquin	10	12	20	20
San Luis Obispo	1	....	2	2
San Mateo	4	2	4	2
Santa Barbara	30	....	1	1
Santa Clara	20	30	23	32
Santa Cruz	1	4	1	4
Shasta	1	1	2	2
Sierra	....	....	1	....
Siskiyou	1	....	1	1
Solano	4	21	7	36
Sonoma	8	4	12	10
Stanislaus	....	....	....	....
Sutter	....	....	1	1
Tehama	1	....	1	1
Trinity	....	....	1	....
Tulare	....	....	....	4
Tuolumne	1	....	1	2
Ventura	2	1	4	1
Yolo	....	2	....	3
Yuba	....	....	....	1
Totals	248	241	264	275

TABLE No. 2—Continued.

COUNTIES.	Number of School Visits made by County Superintendents.		Number of Trustees appointed by County Superintendents.	
	1874.	1875.	1874.	1875.
Alameda	140	138	24	26
Alpine	3	7	3	2
Amador	23	25	8	3
Butte	89	93	24	30
Calaveras	33	45	9	15
Colusa	34	90	35	69
Contra Costa	104	56	23	40
Del Norte	11	20	1	5
El Dorado	42	53	22	19
Fresno	18	20	67	53
Humboldt	33	44	13	11
Inyo	13	16	10	12
Kern	3	11	9	9
Lake	25	122	9	14
Lassen	38	27	2	7
Los Angeles	48	162	24	45
Marin	46	50	14	25
Mariposa	20	25	11	11
Mendocino	55	55	11	23
Merced	23	59	10	10
Modoc	4	10	5	6
Mono	4	4	....	....
Monterey	31	54	17	43
Napa	62	51	24	42
Nevada	72	64	6	10
Placer	76	66	29	27
Plumas	28	32	25	6
Sacramento	242	79	15	23
San Benito	....	83	....	20
San Bernardino	11	22	8	17
San Diego	16	44	9	30
San Francisco	884	781	....	....
San Joaquin	91	201	80	75
San Luis Obispo	20	24	20	10
San Mateo	42	68	24	24
Santa Barbara	18	31	6	9
Santa Clara	78	149	50	70
Santa Cruz	92	63	6	11
Shasta	16	32	13	18
Sierra	17	25	9	14
Siskiyou	5	46	45	31
Solano	52	81	27	54
Sonoma	42	96	41	40
Stanislaus	29	57	25	30
Sutter	3	38	....	25
Tehama	7	28	22	23
Trinity	18	22	6	7
Tulare	2	28	....	....
Tuolumne	20	40	8	3
Ventura	13	15	6	16
Yolo	64	63	50	62
Yuba	109	106	16	11
Totals	2,969	3,621	921	1,186

TABLE No. 2—Continued.

COUNTIES.	Number of Certificates granted to Male Teachers.		Number of Certificates granted to Female Teachers.	
	1874.	1875.	1874.	1875.
Alameda	8	13	22	43
Alpine	1	1	4	2
Amador	9	6	4	11
Butte	12	6	12	9
Calaveras	1	7	5	13
Colusa	6	21	12	10
Contra Costa	4	5	11	8
Del Norte	3	2	4	5
El Dorado	2	9	10	7
Fresno	7	6	4	7
Humboldt	7	10	13	9
Inyo	3	....	1	....
Kern	3	4	6	2
Lake	4	3	15	5
Lassen	2	....	3	....
Los Angeles	19	17	12	17
Marin	5	5	23	21
Mariposa	6	4	4	4
Mendocino	8	6	8	6
Merced	3	5	5	6
Modoc	....	12	....	4
Mono	....	1	....	1
Monterey	11	6	9	13
Napa	11	16	11	17
Nevada	8	26	8	56
Placer	9	7	21	32
Plumas	2	6	6	16
Sacramento	15	18	54	108
San Benito	....	12	....	11
San Bernardino	2	3	3	4
San Diego	5	3	8	7
San Francisco	22	31	193	166
San Joaquin	10	23	18	20
San Luis Obispo	4	6	4	8
San Mateo	6	4	14	18
Santa Barbara	4	6	7	20
Santa Clara	10	11	21	72
Santa Cruz	1	2	9	21
Shasta	2	10	6	13
Sierra	4	12	8	15
Siskiyou	6	7	8	14
Solano	16	14	27	19
Sonoma	13	19	27	29
Stanislaus	5	8	15	12
Sutter	11	10	9	11
Tehama	14	4	4	11
Trinity	....	2	3	10
Tulare	4	....	4	....
Tuolumne	2	3	3	8
Ventura	5	2	4	6
Yolo	11	6	8	15
Yuba	7	11	13	17
Totals	333	431	703	952

TABLE No. 2—Continued.

COUNTIES.	Number of Certificates Renewed.		Number of Applicants Rejected.	
	1874.	1875.	1874.	1875.
Alameda	5	4	51	59
Alpine	....	....	2	....
Amador	3	5	4	9
Butte	9	....	14	19
Calaveras	2	5	7	1
Colusa	2	3	6	13
Contra Costa	5	6	6	20
Del Norte	....	2	....	5
El Dorado	2	....	16	13
Fresno	5	3	5	2
Humboldt	3	2	17	16
Inyo	....	....	....	....
Kern	1	....	3	5
Lake	....	1	8	18
Lassen	4	....	1	....
Los Angeles	3	1	7	32
Marin	3	4	11	15
Mariposa	1	1	2	5
Mendocino	9	10	6	14
Merced	....	....	....	10
Modoc	....	3	....	5
Mono	2	....	....	....
Monterey	5	6	9	25
Napa	1	2	8	21
Nevada	9	4	26	21
Placer	....	2	8	17
Plumas	5	....	4	3
Sacramento	4	2	30	42
San Benito	....	....	....	8
San Bernardino	8	5	4	6
San Diego	2	4	6	10
San Francisco	156	27	195	253
San Joaquin	1	4	30	30
San Luis Obispo	4	....	6	4
San Mateo	....	4	8	14
Santa Barbara	....	....	5	14
Santa Clara	4	....	....	137
Santa Cruz	15	5	22	12
Shasta	....	4	8	6
Sierra	5	....	....	2
Siskiyou	3	6	1	1
Solano	11	3	30	38
Sonoma	5	9	50	90
Stanislaus	6	8	23	17
Sutter	3	....	12	13
Tehama	2	5	6	3
Trinity	....	1	....	2
Tulare	....	....	....	....
Tuolumne	3	2	1	....
Ventura	....	....	1	2
Yolo	12	9	18	25
Yuba	3	2	4	6
Totals	326	164	681	1,083

TABLE No. 2—Continued.

COUNTIES.	Salary of County Superintendents.	
	1874.	1875.
Alameda	$1,800	$1,800
Alpine	100	100
Amador	600	600
Butte	1,500	1,500
Calaveras	600	600
Colusa	860	880
Contra Costa	750	750
Del Norte	150	150
El Dorado	900	900
Fresno	900	900
Humboldt	700	700
Inyo	160	180
Kern	500	500
Lake	650	650
Lassen	200	220
Los Angeles	1,500	1,500
Marin	1,000	1,000
Mariposa	600	350
Mendocino	1,200	902
Merced	1,200	1,200
Modoc	300	300
Mono	80	80
Monterey	800	800
Napa	1,200	1,200
Nevada	1,000	1,000
Placer	1,200	1,200
Plumas	480	480
Sacramento	1,600	1,600
San Benito	....	500
San Bernardino	400	400
San Diego	1,000	1,000
San Francisco	4,000	4,000
San Joaquin	2,000	2,000
San Luis Obispo	420	420
San Mateo	480	560
Santa Barbara	700	700
Santa Clara	1,800	1,800
Santa Cruz	600	600
Shasta	600	600
Sierra	460	480
Siskiyou	660	680
Solano	600	600
Sonoma	1,600	1,600
Stanislaus	1,000	1,000
Sutter	740	720
Tehama	460	480
Trinity	400	400
Tulare	500	500
Tuolumne	440	440
Ventura	300	300
Yolo	700	800
Yuba	1,000	1,000
Totals	$43,390	$43,622

TABLE No. 3.

Statement of financial statistics, showing the receipts, from all sources, of school revenue, for the school years ending June thirtieth, eighteen hundred and seventy-four and eighteen hundred and seventy five.

COUNTIES.	Balance on Hand at the Beginning of School Year.	
	1874.	1875.
Alameda	$5,251 47	$10,426 72
Alpine	637 03	490 99
Amador	5,479 95	6,225 30
Butte	5,270 04	4,761 90
Calaveras	4,971 39	6,633 64
Colusa	6,066 42	6,534 42
Contra Costa	3,259 89	9,459 30
Del Norte	991 55	1,014 80
El Dorado	5,232 64	7,569 07
Fresno	2,445 89	7,519 45
Humboldt	4,377 77	7,262 99
Inyo	2,578 23	1,869 13
Kern	4,180 99	3,294 45
Klamath	771 85	....
Lake	3,675 92	3,212 82
Lassen	1,591 56	1,539 19
Los Angeles	6,952 64	19,034 66
Marin	5,410 27	21,180 13
Mariposa	2,560 22	2,093 93
Mendocino	7,560 72	7,511 20
Merced	7,636 58	8,101 61
Modoc	5,232 73	2,991 82
Mono	2,637 57	1,811 57
Monterey	4,211 56	4,561 83
Napa	6,736 81	10,912 21
Nevada	8,954 64	12,953 43
Placer	3,487 27	7,705 69
Plumas	1,499 41	3,566 80
Sacramento	23,250 84	12,295 99
San Benito	....	1,490 24
San Bernardino	3,073 90	4,538 79
San Diego	11,725 54	3,046 15
San Francisco	119,163 75	39,703 77
San Joaquin	17,145 03	16,297 53
San Luis Obispo	4,087 11	4,015 26
San Mateo	6,462 66	15,867 24
Santa Barbara	3,851 90	3,936 59
Santa Clara	19,695 79	31,947 39
Santa Cruz	6,977 80	5,201 95
Shasta	5,842 22	8,245 87
Sierra	3,150 30	2,269 72
Siskiyou	4,256 90	1,391 17
Solano	7,488 34	8,195 04
Sonoma	10,174 07	10 695 43
Stanislaus	7,886 70	5,556 91
Sutter	4,545 42	3,640 50
Tehama	1,387 99	1,986 76
Trinity	1,648 10	2,410 36
Tulare	3,618 36	2,462 08
Tuolumne	2,920 14	3,412 35
Ventura	1,905 12	2,782 51
Yolo	10,663 86	9,015 71
Yuba	5,901 70	7,116 75
Totals	$405,986 55	$387,761 11

Table No. 3—Continued.

COUNTIES.	Cash Received from State Apportionment.	
	1874.	1875.
Alameda	$20,480 15	$62,351 17
Alpine	353 96	662 60
Amador	6,488 36	17,411 23
Butte	8,187 47	23,726 34
Calaveras	6,786 09	17,455 62
Colusa	4,595 76	15,051 20
Contra Costa	7,844 85	21,834 02
Del Norte	1,046 63	3,180 16
El Dorado	7,101 84	18,588 49
Fresno	3,105 70	8,617 57
Humboldt	6,181 55	19,514 71
Inyo	868 00	2,421 21
Kern	1,652 52	5,692 08
Klamath	827 04	....
Lake	3,088 35	9,176 18
Lassen	1,614 26	5,029 37
Los Angeles	18,839 49	54,575 89
Marin	4,375 94	12,614 28
Mariposa	2,564 23	6,313 07
Mendocino	7,353 19	20,168 40
Merced	2,811 77	8,971 38
Modoc	2,810 86	7,295 35
Mono	267 56	789 36
Monterey	11,209 20	21,681 55
Napa	6,589 61	19,739 30
Nevada	12,726 34	34,369 92
Placer	6,657 96	18,413 34
Plumas	2,271 03	6,055 50
Sacramento	16,765 07	46,173 42
San Benito	....	9,628 10
San Bernardino	4,781 32	13,851 73
San Diego	3,978 34	13,115 70
San Francisco	102,974 53	288,836 75
San Joaquin	14,278 85	38,629 57
San Luis Obispo	5,059 55	13,986 44
San Mateo	6,001 96	16,082 74
Santa Barbara	5,017 16	14,557 62
Santa Clara	20,371 56	59,194 99
Santa Cruz	8,191 21	22,830 06
Shasta	4,004 62	11,069 58
Sierra	3,012 78	8,280 69
Siskiyou	4,386 44	12,842 99
Solano	10,639 64	33,588 38
Sonoma	18,132 73	49,427 71
Stanislaus	5,054 32	13,927 65
Sutter	3,980 75	11,482 51
Tehama	3,249 64	9,861 79
Trinity	1,438 64	4,625 33
Tulare	5,062 90	16,523 43
Tuolumne	5,568 46	14,683 81
Ventura	2,763 53	7,787 34
Yolo	6,448 09	18,379 28
Yuba	7,296 39	19,741 59
Totals	$427,157 89	$1,210,808 49

TABLE No. 3—Continued.

COUNTIES.	Cash Received from County Taxes.	
	1874.	1875.
Alameda	$61,893 77	$36,397 50
Alpine	1,295 56	1,734 14
Amador	14,449 19	8,205 39
Butte	30,918 62	23,889 66
Calaveras	7,752 50	5,736 00
Colusa	20,614 92	15,046 57
Contra Costa	21,754 76	19,603 50
Del Norte	2,600 54	3,826 00
El Dorado	9,322 66	7,731 10
Fresno	20,235 16	11,585 25
Humboldt	16,810 71	25,847 42
Inyo	5,121 07	2,028 07
Kern	6,895 86	5,942 60
Klamath	2,551 64	
Lake	4,316 77	5,250 76
Lassen	4,321 27	5,902 46
Los Angeles	37,849 03	24,871 56
Marin	25,492 80	11,807 16
Mariposa	4,279 63	4,180 00
Mendocino	15,408 80	15,307 60
Merced	15,658 33	8,871 84
Modoc	4,014 83	3,813 51
Mono	1,861 01	981 32
Monterey	26,181 85	12,308 75
Napa	18,457 39	14,737 53
Nevada	40,491 50	32,236 56
Placer	19,733 26	17,667 05
Plumas	9,531 07	8,287 29
Sacramento	62,172 78	31,422 13
San Benito		5,371 61
San Bernardino	6,341 44	4,685 62
San Diego	6,585 12	8,159 40
San Francisco	457,637 38	391,654 30
San Joaquin	46,090 00	39,025 70
San Luis Obispo	6,356 71	7,920 32
San Mateo	25,310 25	19,866 40
Santa Barbara	6,688 27	9,947 31
Santa Clara	40,330 00	43,182 00
Santa Cruz	18,739 00	17,360 29
Shasta	11,178 67	6,732 49
Sierra	6,391 23	8,301 69
Siskiyou	8,147 55	10,659 96
Solano	38,316 98	32,751 20
Sonoma	36,493 23	47,054 93
Stanislaus	17,120 00	21,230 92
Sutter	7,012 54	16,470 00
Tehama	10,755 06	11,998 81
Trinity	4,968 00	3,565 58
Tulare	10,936 54	10,927 97
Tuolumne	8,273 45	3,107 00
Ventura	4,631 98	4,754 68
Yolo	25,652 44	13,822 46
Yuba	16,265 70	11,760 70
Totals	$1,332,208 82	$1,115,530 06

TABLE No. 3—Continued.

COUNTIES.	Cash Received from City and District Taxes.	
	1874.	1875.
Alameda	$58,385 36	$75,121 57
Alpine	77 70	
Amador		4,425 29
Butte	2,482 64	8,010 58
Calaveras	357 41	
Colusa		
Contra Costa	6,921 69	4,104 46
Del Norte	1,217 50	
El Dorado	3,593 17	703 00
Fresno	500 00	4,145 44
Humboldt	1,906 84	371 47
Inyo		
Kern	762 88	
Klamath		
Lake	868 13	1,024 65
Lassen		1,468 52
Los Angeles	11,448 35	12,088 33
Marin	7,172 34	1,134 36
Mariposa		
Mendocino	1,948 68	1,321 46
Merced	407 20	2,228 60
Modoc	505 24	
Mono		
Monterey	3,619 91	2,529 68
Napa	4,930 46	6,048 47
Nevada	6,386 60	4,847 42
Placer	3,346 48	228 00
Plumas		
Sacramento	28,014 27	46,581 23
San Benito		7,650 42
San Bernardino		
San Diego	1,100 00	
San Francisco		
San Joaquin	16,178 08	16,705 41
San Luis Obispo	818 89	4,676 21
San Mateo		4,174 89
Santa Barbara	702 99	12,301 95
Santa Clara	33,194 50	33,516 31
Santa Cruz	1,815 75	4,784 20
Shasta	2,368 47	1,120 28
Sierra	1,449 75	914 34
Siskiyou	2,656 30	6,302 74
Solano	2,446 06	9,207 71
Sonoma	4,508 43	19,614 95
Stanislaus		
Sutter	4,664 70	880 00
Tehama	1,701 95	1,961 67
Trinity		
Tulare	2,111 24	138 43
Tuolumne		
Ventura	1,725 93	3,297 08
Yolo	5,628 33	6,437 66
Yuba	7,896 87	5,615 88
Totals	$235,821 09	$315,682 66

TABLE No. 3—Continued.

COUNTIES.	Cash Receipts from Miscellaneous Sources.	
	1874.	1875.
Alameda	$7,466 20	$14,487 80
Alpine	85 00	....
Amador	621 00	993 54
Butte	105 25	2,583 20
Calaveras	2,496 08	1,947 79
Colusa	815 66	11,668 05
Contra Costa	3,880 13	2,068 12
Del Norte	44 00	....
El Dorado	5,518 43	2,370 00
Fresno	569 48	303 75
Humboldt	646 43	651 50
Inyo	1,138 58	1,138 20
Kern	....	152 50
Lake	713 86	402 93
Lassen	....	121 94
Los Angeles	1,129 50	5,631 14
Marin	3,307 68	40 00
Mariposa	219 75	....
Mendocino	412 41	503 51
Merced	68 48	21,664 05
Modoc	260 16	113 17
Mono	....	385 93
Monterey	637 00	9,811 73
Napa	106 36	20 00
Nevada	....	....
Placer	3,581 05	3,386 26
Plumas	1,574 01	188 50
Sacramento	831 75	24 75
San Benito	....	269 55
San Bernardino	285 03	869 07
San Diego	....	576 80
San Francisco	48,950 75	266,230 93
San Joaquin	3,472 14	2,262 16
San Luis Obispo	400 00	502 00
San Mateo	1,367 20	....
Santa Barbara	381 86	826 00
Santa Clara	2,247 70	950 00
Santa Cruz	462 68	370 02
Shasta	159 50	45 40
Sierra	2,029 91	1,705 55
Siskiyou	257 75	569 95
Solano	8,196 44	1,440 45
Sonoma	2,293 16	300 82
Stanislaus	1,829 81	....
Sutter	169 30	636 27
Tehama	71 00	....
Trinity	....	58 34
Tulare	525 05	2,265 20
Tuolumne	....	....
Ventura	....	....
Yolo	38 04	....
Yuba	130 29	40 11
Totals	$109,495 86	$360,576 98

TABLE No. 3—Continued.

COUNTIES.	Total Receipts.	
	1874.	1875.
Alameda	$153,476 95	$198,784 76
Alpine	2,449 25	2,887 73
Amador	27,038 50	37,260 75
Butte	46,964 02	62,971 68
Calaveras	22,363 47	31,773 05
Colusa	32,092 76	48,300 24
Contra Costa	43,661 32	57,069 40
Del Norte	5,900 22	8,020 96
El Dorado	30,768 74	36,961 66
Fresno	26,856 23	32,171 46
Humboldt	29,923 30	53,648 09
Inyo	9,705 88	7,456 61
Kern	13,492 25	15,081 63
Klamath	4,150 53	....
Lake	12,663 03	19,067 34
Lassen	7,527 09	14,061 48
Los Angeles	76,219 01	116,201 58
Marin	45,759 03	46,775 93
Mariposa	9,623 83	12,587 00
Mendocino	32,683 80	44,812 17
Merced	26,582 36	49,837 48
Modoc	12,823 52	14,213 85
Mono	4,766 14	3,968 18
Monterey	45,859 52	50,893 54
Napa	36,820 63	51,457 51
Nevada	68,559 08	84,407 33
Placer	36,806 02	47,400 34
Plumas	14,875 52	18,098 09
Sacramento	131,034 71	136,497 52
San Benito	....	24,409 92
San Bernardino	14,481 69	23,945 21
San Diego	23,389 00	24,898 05
San Francisco	728,726 41	986,425 75
San Joaquin	97,164 10	112,920 37
San Luis Obispo	16,722 16	31,100 23
San Mateo	39,142 07	55,991 27
Santa Barbara	16,642 18	41,569 47
Santa Clara	115,839 55	168,790 69
Santa Cruz	36,186 44	50,546 52
Shasta	23,553 48	27,213 62
Sierra	16,033 97	21,471 99
Siskiyou	19,704 94	31,766 81
Solano	67,087 46	85,182 78
Sonoma	71,601 62	127,093 84
Stanislaus	31,390 83	40,715 48
Sutter	20,372 71	33,109 28
Tehama	17,165 64	25,809 03
Trinity	8,054 74	10,659 61
Tulare	22,254 09	32,317 11
Tuolumne	16,762 05	21,203 16
Ventura	11,026 56	18,621 61
Yolo	48,430 76	47,655 11
Yuba	37,490 95	44,275 03
Totals	$2,510,670 11	$3,390,359 30

TABLE No. 4.

Financial statistics, showing school expenditures for the school years ending June thirtieth, eighteen hundred and seventy-two and eighteen hundred and seventy-three.

COUNTIES.	Amount Paid for Teachers' Salaries. 1874.	1875.
Alameda	$94,824 41	$104,798 31
Alpine	2,154 82	2,100 98
Amador	18,172 93	18,185 00
Butte	27,588 68	32,251 82
Calaveras	13,956 47	20,345 82
Colusa	22,731 52	26,798 31
Contra Costa	24,617 89	28,913 93
Del Norte	3,351 00	5,309 91
El Dorado	15,503 81	22,482 85
Fresno	14,961 75	16,215 55
Humboldt	18,580 75	27,442 40
Inyo	5,274 50	5,775 50
Kern	7,398 33	8,499 64
Klamath	2,531 82	....
Lake	7,149 43	10,942 06
Lassen	5,443 00	6,822 03
Los Angeles	39,793 25	57,033 50
Marin	15,386 08	20,233 51
Mariposa	6,901 78	8,589 53
Mendocino	21,393 27	26,596 47
Merced	15,824 52	15,810 73
Modoc	6,569 46	8,823 18
Mono	2,222 50	2,396 25
Monterey	29,194 34	26,598 95
Napa	17,764 94	25,557 28
Nevada	40,681 85	49,779 35
Placer	22,346 00	29,328 88
Plumas	9,250 12	11,176 40
Sacramento	69,881 44	76,599 90
San Benito	....	11,312 90
San Bernardino	7,448 94	12,564 26
San Diego	13,858 65	14,282 99
San Francisco	516,388 65	519,138 72
San Joaquin	59,707 43	67,817 30
San Luis Obispo	11,305 37	15,708 72
San Mateo	17,007 50	21,450 25
Santa Barbara	8,703 30	12,132 16
Santa Clara	62,382 00	71,422 50
Santa Cruz	25,704 06	28,293 86
Shasta	12,077 58	15,090 30
Sierra	11,631 50	14,021 50
Siskiyou	13,232 59	18,803 46
Solano	40,816 96	52,083 09
Sonoma	49,907 87	70,778 24
Stanislaus	20,399 74	23,089 91
Sutter	12,774 13	19,907 28
Tehama	12,069 55	16,390 85
Trinity	4,797 60	6,609 06
Tulare	12,641 25	23,200 38
Tuolumne	10,638 82	13,846 34
Ventura	6,321 93	8,551 16
Yolo	25,316 43	29,051 42
Yuba	24,247 65	29,524 93
Totals	$1,560,830 16	$1,810,479 62

Table No. 4—Continued.

COUNTIES.	Amount Paid for Rent, Repairs, Fuel, and Contingent Expenses. 1874.	1875.
Alameda	$19,883 88	$21,181 22
Alpine	91 64	128 78
Amador	1,516 31	1,753 86
Butte	2,910 65	8,077 21
Calaveras	1,499 26	3,099 57
Colusa	2,627 40	3,236 79
Contra Costa	3,486 15	6,142 75
Del Norte	356 71	1,186 72
El Dorado	2,398 34	2,977 67
Fresno	2,438 44	1,943 14
Humboldt	2,068 37	5,125 53
Inyo	1,106 34	419 67
Kern	667 06	1,314 79
Klamath	83 00	....
Lake	780 33	1,049 13
Lassen	524 90	807 58
Los Angeles	7,505 56	10,586 14
Marin	7,323 27	3,486 58
Mariposa	579 86	715 02
Mendocino	1,104 19	3,137 67
Merced	2,057 77	4,005 35
Modoc	363 38	2,425 79
Mono	432 07	441 27
Monterey	4,574 41	3,625 55
Napa	5,306 54	5,041 29
Nevada	8,089 23	13,616 65
Placer	1,996 45	2,524 45
Plumas	869 23	1,183 23
Sacramento	18,711 73	17,069 07
San Benito	....	2,556 48
San Bernardino	1,479 09	1,044 50
San Diego	2,206 90	1,372 12
San Francisco	143,650 22	147,778 10
San Joaquin	17,071 87	15,257 95
San Luis Obispo	903 02	5,873 40
San Mateo	5,014 52	5,094 39
Santa Barbara	3,773 56	5,317 99
Santa Clara	15,732 92	20,024 98
Santa Cruz	3,679 64	5,007 12
Shasta	1,635 00	2,346 37
Sierra	1,065 59	912 38
Siskiyou	1,481 11	2,398 64
Solano	7,770 89	9,557 28
Sonoma	4,340 90	5,351 14
Stanislaus	1,752 22	3,449 33
Sutter	1,888 74	2,533 99
Tehama	3,166 48	5,001 53
Trinity	570 51	810 30
Tulare	1,784 39	2,873 36
Tuolumne	1,561 65	2,020 21
Ventura	678 47	898 13
Yolo	6,319 16	3,777 47
Yuba	3,072 98	4,246 99
Totals	$331,952 30	$381,806 62

TABLE No. 4—Continued.

COUNTIES.	AMOUNT PAID FOR SCHOOL LIBRARIES.	
	1874.	1875.
Alameda	$1,001 40	$1,291 12
Alpine	45 50	56 80
Amador	406 49	482 89
Butte	736 08	532 45
Calaveras	34 25	445 44
Colusa	523 31	1,187 59
Contra Costa	562 72	957 59
Del Norte	46 85	146 79
El Dorado	513 38	657 15
Fresno	190 38	363 06
Humboldt	411 50	588 20
Inyo	123 79	79 61
Kern	156 45	223 99
Klamath	83 00	
Lake	281 58	388 88
Lassen	20 00	104 50
Los Angeles	918 14	1,745 23
Marin	224 67	501 22
Mariposa	222 92	276 50
Mendocino	202 43	818 26
Merced	324 36	733 60
Modoc	270 08	723 51
Mono		
Monterey	643 94	571 88
Napa	91 31	925 75
Nevada	881 09	1,509 94
Placer	413 21	1,121 29
Plumas	107 40	327 55
Sacramento	420 93	642 43
San Benito		403 86
San Bernardino	473 18	256 05
San Diego	296 39	363 81
San Francisco	3,000 00	2,469 32
San Joaquin	832 37	1,159 68
San Luis Obispo	165 36	249 82
San Mateo	341 48	1,190 60
Santa Barbara	88 83	353 72
Santa Clara	1,264 06	1,242 81
Santa Cruz	527 05	836 12
Shasta	504 12	805 80
Sierra	221 24	200 95
Siskiyou	629 15	73 07
Solano		1,213 04
Sonoma	965 29	1,707 42
Stanislaus	396 92	786 02
Sutter	58 29	312 10
Tehama	69 59	454 26
Trinity	107 00	255 94
Tulare	285 04	582 62
Tuolumne	358 99	326 54
Ventura	108 35	273 86
Yolo	574 45	304 56
Yuba	628 51	737 53
Totals	$21,752 82	$33,962 72

TABLE No. 4—Continued.

COUNTIES.	AMOUNT PAID FOR SCHOOL APPARATUS.	
	1874.	1875.
Alameda	$80 36	$80 29
Alpine	5 60	
Amador	24 75	82 05
Butte	291 60	720 10
Calaveras		224 12
Colusa	96 50	400 96
Contra Costa	72 57	135 51
Del Norte	5 00	
El Dorado	32 38	91 76
Fresno		107 10
Humboldt	102 10	90 49
Inyo		71 10
Kern	202 27	66 05
Klamath		
Lake	58 39	69 14
Lassen		224 53
Los Angeles	893 18	1,813 38
Marin	20 00	
Mariposa	20 49	
Mendocino	148 69	183 05
Merced		197 63
Modoc	10 00	3 00
Mono		
Monterey	38 12	228 16
Napa	25 76	
Nevada		
Placer	321 73	529 27
Plumas	61 50	154 32
Sacramento	243 32	596 44
San Benito		33 60
San Bernardino	30 32	47 55
San Diego	33 55	
San Francisco		
San Joaquin		117 95
San Luis Obispo	25 55	
San Mateo	172 15	420 70
Santa Barbara	140 00	76 70
Santa Clara	398 60	1,050 50
Santa Cruz	95 92	336 20
Shasta		
Sierra	121 39	30 00
Siskiyou	36 00	107 91
Solano	225 85	396 80
Sonoma	20 50	511 51
Stanislaus	26 56	33 00
Sutter		235 70
Tehama		
Trinity		37 00
Tulare	72 10	79 88
Tuolumne		100 37
Ventura		
Yolo		945 60
Yuba		83 60
Totals	$4,152 80	$10,713 02

TABLE No. 4—Continued.

COUNTIES.	TOTAL CURRENT EXPENSES.	
	1874.	1875.
Alameda	$115,790 05	$127,350 94
Alpine	2,297 56	2,286 56
Amador	20,120 48	20,503 80
Butte	31,527 01	41,581 58
Calaveras	15,489 98	24,114 95
Colusa	25,978 73	31,623 65
Contra Costa	28,739 33	36,149 78
Del Norte	3,759 56	6,643 42
El Dorado	18,447 91	26,209 43
Fresno	17,590 57	18,628 85
Humboldt	21,162 72	33,246 62
Inyo	6,504 63	6,345 88
Kern	8,424 11	10,104 47
Klamath	2,697 82	....
Lake	8,269 73	12,449 21
Lassen	5,987 90	7,958 64
Los Angeles	49,110 13	71,178 25
Marin	22,954 02	24,221 31
Mariposa	7,725 05	9,581 05
Mendocino	22,848 58	30,735 45
Merced	18,206 65	20,747 31
Modoc	7,212 92	11,975 48
Mono	2,654 57	2,837 52
Monterey	34,450 81	31,024 54
Napa	23,188 55	31,524 32
Nevada	49,652 17	64,905 94
Placer	25,077 39	33,503 89
Plumas	10,288 25	12,841 50
Sacramento	89,257 42	94,907 84
San Benito	....	14,306 84
San Bernardino	9,431 53	13,912 36
San Diego	16,395 49	16,018 92
San Francisco	663,038 87	669,386 14
San Joaquin	77,611 67	84,352 88
San Luis Obispo	12,399 30	21,831 94
San Mateo	22,535 65	28,155 94
Santa Barbara	12,705 69	17,880 57
Santa Clara	79,777 58	93,740 79
Santa Cruz	30,006 67	34,473 30
Shasta	14,216 70	18,242 47
Sierra	13,039 72	15,164 83
Siskiyou	15,378 85	21,383 08
Solano	48,813 70	63,250 21
Sonoma	55,234 56	78,348 31
Stanislaus	22,575 44	27,358 26
Sutter	14,721 16	22,989 07
Tehama	15,305 62	21,846 64
Trinity	5,475 11	7,712 30
Tulare	14,782 78	26,736 24
Tuolumne	12,559 46	16,293 46
Ventura	7,108 75	9,723 15
Yolo	32,210 04	34,079 05
Yuba	27,949 14	34,593 05
Totals	$1,918,688 08	$2,236,961 98

TABLE No. 4—Continued.

COUNTIES.	AMOUNT PAID FOR SITES, BUILDINGS, AND SCHOOL FURNITURE.	
	1874.	1875.
Alameda	$25,167 43	$51,487 83
Alpine	65 75	....
Amador	699 50	5,043 95
Butte	2,713 91	10,814 23
Calaveras	855 10	571 56
Colusa	494 55	10,837 52
Contra Costa	5,543 59	4,467 17
Del Norte	1,125 86	518 48
El Dorado	5,051 20	1,697 86
Fresno	1,434 48	4,346 51
Humboldt	2,947 31	3,155 94
Inyo	1,331 00	241 68
Kern	1,773 69	45 25
Klamath	....	....
Lake	1,155 70	2,239 22
Lassen	3,024 88	2,634 03
Los Angeles	7,325 20	14,692 71
Marin	1,785 86	4,289 50
Mariposa	20 00	....
Mendocino	2,324 02	....
Merced	994 57	21,929 58
Modoc	1,477 63	136 00
Mono	300 00	25 00
Monterey	4,777 99	12,301 90
Napa	2,535 32	3,444 17
Nevada	5,953 86	1,803 66
Placer	3,503 98	7,639 99
Plumas	827 10	517 82
Sacramento	29,629 60	4,293 05
San Benito	....	7,345 25
San Bernardino	511 37	2,377 01
San Diego	3,201 90	225 38
San Francisco	25,983 79	134,221 22
San Joaquin	3,346 32	9,431 45
San Luis Obispo	317 70	207 25
San Mateo	739 15	10,080 65
Santa Barbara	....	11,966 83
Santa Clara	2,755 98	19,900 96
Santa Cruz	979 56	1,216 73
Shasta	1,090 81	870 08
Sierra	725 53	1,144 75
Siskiyou	2,934 39	5,804 51
Solano	10,076 97	8,799 61
Sonoma	5,912 11	20,616 61
Stanislaus	3,348 16	1,163 78
Sutter	1,587 30	1,590 03
Tehama	813 33	620 61
Trinity	....	285 50
Tulare	2,283 25	1,786 00
Tuolumne	611 39	....
Ventura	1,161 60	3,970 50
Yolo	6,822 50	6,541 86
Yuba	2,425 06	1,938 18
Totals	$192,467 25	$421,279 36

TABLE No. 4—Continued.

COUNTIES.	TOTAL EXPENDITURES. 1874.	TOTAL EXPENDITURES. 1875.
Alameda	$140,957 48	$178,838 77
Alpine	2,363 31	2,286 56
Amador	20,819 98	25,547 75
Butte	34,240 92	52,395 81
Calaveras	16,345 08	24,686 51
Colusa	26,473 28	42,461 17
Contra Costa	34,282 92	40,616 95
Del Norte	4,885 42	7,161 90
El Dorado	23,499 11	27,907 29
Fresno	19,025 05	22,975 36
Humboldt	24,110 03	36,402 56
Inyo	7,835 63	6,587 56
Kern	10,197 80	10,149 72
Klamath	2,697 82	....
Lake	9,425 43	14,688 43
Lassen	9,012 78	10,592 67
Los Angeles	56,435 33	85,870 96
Marin	24,739 88	28,510 81
Mariposa	7,745 05	9,581 05
Mendocino	25,172 60	30,735 45
Merced	19,201 22	42,676 89
Modoc	8,690 55	12,111 48
Mono	2,954 57	2,862 52
Monterey	39,228 80	43,326 44
Napa	25,723 87	34,968 49
Nevada	55,606 03	66,709 60
Placer	28,581 37	41,143 88
Plumas	11,115 35	13,359 32
Sacramento	118,887 02	99,200 89
San Benito	....	21,652 09
San Bernardino	9,942 90	16,289 37
San Diego	19,597 39	16,244 30
San Francisco	689,022 64	803,607 36
San Joaquin	80,957 99	93,784 33
San Luis Obispo	12,717 00	22,039 19
San Mateo	23,274 80	38,236 59
Santa Barbara	12,705 69	29,847 40
Santa Clara	82,533 56	113,641 75
Santa Cruz	30,986 23	35,690 03
Shasta	15,307 51	19,112 55
Sierra	13,765 25	16,309 58
Siskiyou	18,313 24	27,187 59
Solano	58,890 67	72,049 82
Sonoma	61,146 67	98,964 92
Stanislaus	25,923 60	28,522 04
Sutter	16,308 46	24,579 10
Tehama	16,118 95	22,467 25
Trinity	5,475 11	7,997 80
Tulare	17,066 03	28,522 24
Tuolumne	13,170 85	16,293 46
Ventura	8,270 35	13,693 65
Yolo	39,032 54	40,620 91
Yuba	30,374 20	36,531 23
Totals	$2,111,155 33	$2,658,241 34

TABLE No. 4—Continued.

COUNTIES.	BALANCE ON HAND AT CLOSE OF SCHOOL YEAR. 1874.	BALANCE ON HAND AT CLOSE OF SCHOOL YEAR. 1875.
Alameda	$12,519 47	....
Alpine	85 94	....
Amador	6,218 52	....
Butte	12,723 10	....
Calaveras	6,018 39	....
Colusa	6,232 47	....
Contra Costa	9,389 40	....
Del Norte	1,014 80	....
El Dorado	7,269 63	....
Fresno	7,831 18	....
Humboldt	5,818 27	....
Inyo	1,869 13	....
Kern	3,294 45	....
Klamath	1,552 71	....
Lake	3,242 54	....
Lassen	1,539 19	....
Los Angeles	19,130 23	....
Marin	21,019 15	....
Mariposa	2,104 80	....
Mendocino	7,511 20	....
Merced	7,381 10	....
Modoc	....	....
Mono	1,811 57	....
Monterey	6,607 88	....
Napa	10,747 48	....
Nevada	13,026 86	....
Placer	8,224 65	....
Plumas	3,760 17	....
Sacramento	12,403 21	....
San Benito	....	....
San Bernardino	4,538 79	....
San Diego	3,792 61	....
San Francisco	39,703 77	....
San Joaquin	16,206 11	....
San Luis Obispo	4,005 26	....
San Mateo	15,867 24	....
Santa Barbara	3,936 49	....
Santa Clara	33,395 99	....
Santa Cruz	5,199 21	....
Shasta	8,245 87	....
Sierra	2,269 82	....
Siskiyou	1,391 70	....
Solano	8,194 79	....
Sonoma	5,485 20	....
Stanislaus	5,467 23	....
Sutter	4,030 03	....
Tehama	989 60	....
Trinity	2,579 63	....
Tulare	2,664 84	....
Tuolumne	3,413 24	....
Ventura	2,756 21	....
Yolo	9,398 22	....
Yuba	7,116 75	....

TABLE No. 4—Continued.

COUNTIES.	CASH DRAWN FROM UNAPPORTIONED COUNTY FUND FOR COUNTY INSTITUTE.	
	1874.	1875.
Alameda	$100 00	$100 00
Alpine	....	....
Amador	100 00	100 00
Butte	50 00	63 50
Calaveras	75 00	60 00
Colusa	100 00	100 00
Contra Costa	50 00	75 00
Del Norte	....	....
El Dorado	75 00	12 00
Fresno	....	....
Humboldt	10 50	46 50
Inyo	....	....
Kern	100 00	....
Lake	5 25	33 00
Lassen	....	....
Los Angeles	100 00	100 00
Marin	....	100 00
Mariposa	....	....
Mendocino	80 00	97 50
Merced	....	100 00
Modoc	....	40 50
Mono	....	....
Monterey	100 00	100 00
Napa	80 00	100 00
Nevada	77 10	126 50
Placer	77 00	100 00
Plumas	....	....
Sacramento	100 00	100 00
San Benito	....	....
San Bernardino	69 75	100 00
San Diego	95 00	100 00
San Francisco	....	....
San Joaquin	....	100 00
San Luis Obispo	....	42 50
San Mateo	....	100 00
Santa Barbara	....	....
Santa Clara	....	100 00
Santa Cruz	83 00	85 00
Shasta	53 00	79 75
Sierra	100 00	....
Siskiyou	100 00	100 00
Solano	30 00	100 00
Sonoma	100 00	....
Stanislaus	47 00	100 00
Sutter	....	27 20
Tehama	100 00	45 50
Trinity	....	....
Tulare	....	74 75
Tuolumne	....	....
Ventura	....	100 00
Yolo	100 00	100 00
Yuba	....	27 20
Totals	$2,157 60	$2,936 40

TABLE No. 4—Continued.

COUNTIES.	CASH DRAWN FROM UNAPPORTIONED COUNTY FUND FOR BOARD OF EXAMINATION.	
	1874.	1875.
Alameda	$287 00	$325 60
Alpine	87 00	99 00
Amador	282 15	352 00
Butte	253 50	187 98
Calaveras	227 00	280 00
Colusa	330 00	320 00
Contra Costa	199 25	218 25
Del Norte	80 00	174 75
El Dorado	166 50	200 00
Fresno	313 50	398 75
Humboldt	293 50	332 00
Inyo	48 00	....
Kern	300 00	360 00
Lake	287 50	288 10
Lassen	30 00	....
Los Angeles	314 70	391 55
Marin	313 18	366 15
Mariposa	192 50	219 25
Mendocino	176 50	259 50
Merced	146 00	164 50
Modoc	....	200 84
Mono	....	....
Monterey	404 00	408 00
Napa	244 00	299 00
Nevada	160 00	190 00
Placer	235 00	223 84
Plumas	40 00	150 00
Sacramento	255 00	358 00
San Benito	....	300 00
San Bernardino	159 00	161 00
San Diego	169 50	117 00
San Francisco	....	....
San Joaquin	180 00	175 00
San Luis Obispo	205 75	385 00
San Mateo	202 00	204 00
Santa Barbara	123 00	144 00
Santa Clara	500 00	560 00
Santa Cruz	169 50	188 00
Shasta	280 00	301 00
Sierra	44 00	219 50
Siskiyou	180 00	188 50
Solano	320 00	256 00
Sonoma	240 00	364 00
Stanislaus	418 00	424 15
Sutter	204 00	218 07
Tehama	238 00	280 00
Trinity	....	15 00
Tulare	123 50	240 50
Tuolumne	....	115 50
Ventura	197 20	227 00
Yolo	320 00	320 00
Yuba	169 50	226 37
Totals	$10,108 73	$12,396 65

TABLE No. 4—Continued.

COUNTIES.	CASH DRAWN FROM UNAPPORTIONED COUNTY FUND FOR POSTAGE, STATIONERY, ETC.	
	1874.	1875.
Alameda	$64 75	$58 50
Alpine	50 00	50 00
Amador	50 00	15 00
Butte	50 00	53 00
Calaveras	155 15	243 65
Colusa	38 00	50 00
Contra Costa	....	35 00
Del Norte	21 05	64 50
El Dorado	45 62	....
Fresno	23 00	34 00
Humboldt	68 00	61 00
Inyo	8 00	9 00
Kern	15 50	30 75
Lake	37 00	56 00
Lassen	20 00	....
Los Angeles	38 00	350 15
Marin	86 05	121 13
Mariposa	73 50	85 00
Mendocino	20 00	33 00
Merced	42 92	37 21
Modoc	....	23 00
Mono	....	....
Monterey	42 00	396 00
Napa	137 00	40 00
Nevada	....	....
Placer	62 00	55 50
Plumas	33 00	26 20
Sacramento	67 00	88 50
San Benito	....	256 58
San Bernardino	37 00	20 00
San Diego	15 00	9 00
San Francisco	....	....
San Joaquin	118 70	167 00
San Luis Obispo	45 00	45 00
San Mateo	44 50	24 00
Santa Barbara	37 00	29 50
Santa Clara	52 00	260 00
Santa Cruz	93 50	56 25
Shasta	18 50	30 25
Sierra	50 00	100 00
Siskiyou	121 50	94 00
Solano	50 00	50 00
Sonoma	87 00	576 00
Stanislaus	96 00	85 83
Sutter	53 35	36 00
Tehama	25 00	45 00
Trinity	10 00	10 00
Tulare	129 87	50 00
Tuolumne	....	91 25
Ventura	38 00	26 50
Yolo	61 00	41 00
Yuba	37 75	44 00
Totals	$2,468 21	$4,163 25

TABLE No. 4—Continued.

COUNTIES.	TOTAL EXPENDITURES FROM UNAPPORTIONED COUNTY SCHOOL FUND.	
	1874.	1875.
Alameda	$451 75	$484 10
Alpine	137 00	149 00
Amador	432 15	467 00
Butte	353 50	304 48
Calaveras	457 15	583 65
Colusa	468 00	470 00
Contra Costa	249 25	328 25
Del Norte	101 05	239 25
El Dorado	287 12	212 00
Fresno	336 50	432 75
Humboldt	372 00	439 50
Inyo	56 00	9 00
Kern	415 50	390 75
Lake	329 75	377 10
Lassen	50 00	....
Los Angeles	452 70	841 70
Marin	399 23	587 28
Mariposa	266 00	304 25
Mendocino	276 50	390 00
Merced	188 92	301 71
Modoc	....	264 34
Mono	....	....
Monterey	546 00	904 00
Napa	461 00	439 00
Nevada	237 10	316 50
Placer	374 00	379 34
Plumas	73 00	176 20
Sacramento	422 00	546 50
San Benito	....	556 58
San Bernardino	265 75	281 00
San Diego	279 50	226 00
San Francisco	....	....
San Joaquin	298 70	442 00
San Luis Obispo	250 75	472 50
San Mateo	246 50	328 00
Santa Barbara	160 00	173 50
Santa Clara	552 00	920 00
Santa Cruz	346 00	329 25
Shasta	351 50	411 00
Sierra	194 00	319 50
Siskiyou	401 50	382 50
Solano	400 00	406 00
Sonoma	427 00	940 00
Stanislaus	561 00	609 98
Sutter	257 35	281 27
Tehama	363 00	370 50
Trinity	10 00	25 00
Tulare	253 37	365 25
Tuolumne	....	206 75
Ventura	235 20	353 50
Yolo	481 00	461 00
Yuba	207 25	297 57
Totals	$14,734 54	$19,496 30

TABLE No. 5.

Valuation of school property.

COUNTIES.	Valuation of Lots, School Houses, and Furniture.	
	1874.	1875.
Alameda	$273,180 00	$339,350 00
Alpine	1,000 00	400 00
Amador	20,753 00	27,670 00
Butte	53,138 25	73,253 00
Calaveras	18,395 00	21,387 00
Colusa	30,037 00	40,503 25
Contra Costa	43,280 00	45,655 00
Del Norte	6,481 50	6,760 25
El Dorado	23,403 57	27,985 00
Fresno	7,815 73	16,028 28
Humboldt	27,530 00	35,122 00
Inyo	6,460 00	6,460 00
Kern	9,450 00	7,150 00
Klamath	2,450 00	....
Lake	10,725 00	11,903 00
Lassen	8,700 00	9,810 00
Los Angeles	107,704 37	121,754 00
Marin	33,019 00	37,140 00
Mariposa	6,500 00	6,570 00
Mendocino	36,285 16	34,246 04
Merced	16,859 00	40,558 75
Modoc	4,456 58	5,923 65
Mono	2,060 00	2,300 00
Monterey	40,323 31	39,470 45
Napa	50,127 66	56,752 00
Nevada	90,216 66	94,881 00
Placer	34,370 00	42,270 00
Plumas	10,149 00	12,641 82
Sacramento	169,062 56	169,062 56
San Benito	....	24,452 52
San Bernardino	15,071 00	18,815 00
San Diego	12,200 00	13,225 00
San Francisco	2,207,951 00	2,357,000 00
San Joaquin	208,200 00	216,750 00
San Luis Obispo	9,800 00	13,375 00
San Mateo	41,950 00	54,480 00
Santa Barbara	30,700 00	43,902 68
Santa Clara	164,267 00	222,665 00
Santa Cruz	39,886 00	46,521 00
Shasta	12,918 00	12,343 00
Sierra	5,460 00	6,160 00
Siskiyou	23,925 00	23,205 00
Solano	88,227 50	97,750 00
Sonoma	56,625 50	124,682 63
Stanislaus	21,347 00	49,762 00
Sutter	28,975 00	28,925 00
Tehama	28,500 00	30,300 00
Trinity	3,627 00	4,175 00
Tulare	9,735 00	20,871 74
Tuolumne	16,075 00	17,068 77
Ventura	16,775 00	21,500 00
Yolo	34,865 00	49,020 00
Yuba	48,872 00	49,372 00
Totals	$4,269,884 35	$4,879,328 39

Table No. 5—Continued.

COUNTIES.	Valuation of School Libraries.	
	1874.	1875.
Alameda	$4,954 00	$6,117 00
Alpine	97 50	148 00
Amador	1,523 00	1,557 50
Butte	4,313 16	3,828 75
Calaveras	881 20	1,144 49
Colusa	1,753 00	2,469 56
Contra Costa	3,530 87	3,850 00
Del Norte	148 85	276 44
El Dorado	3,861 02	5,135 50
Fresno	812 73	1,148 95
Humboldt	1,937 00	2,770 00
Inyo	253 76	333 37
Kern	475 22	611 00
Klamath	170 00	....
Lake	1,073 10	1,407 00
Lassen	474 50	465 25
Los Angeles	4,866 13	6,860 33
Marin	3,045 00	2,970 00
Mariposa	1,247 00	1,224 00
Mendocino	2,510 02	2,971 98
Merced	932 76	1,634 30
Modoc	345 67	312 00
Mono	....	....
Monterey	3,276 43	2,998 30
Napa	2,253 50	925 75
Nevada	5,011 01	6,160 00
Placer	3,087 00	3,365 00
Plumas	1,303 50	1,571 05
Sacramento	4,135 77	4,135 77
San Benito	....	1,056 27
San Bernardino	2,134 47	2,490 00
San Diego	571 75	646 00
San Francisco	19,669 00	10,000 00
San Joaquin	5,170 00	5,135 00
San Luis Obispo	1,667 83	1,847 42
San Mateo	2,264 47	3,600 00
Santa Barbara	1,007 00	1,329 50
Santa Clara	7,061 00	7,163 00
Santa Cruz	2,531 00	3,085 75
Shasta	1,966 50	2,559 00
Sierra	1,425 00	1,895 00
Siskiyou	1,567 50	1,498 00
Solano	4,080 75	5,185 00
Sonoma	3,016 85	6,686 60
Stanislaus	2,047 00	2,652 92
Sutter	652 00	949 50
Tehama	1,700 00	2,030 00
Trinity	632 00	822 00
Tulare	868 65	1,568 80
Tuolumne	2,653 00	2,332 00
Ventura	768 00	1,675 00
Yolo	3,180 00	3,307 00
Yuba	2,659 66	2,659 66
Totals	$127,566 13	$138,564 64

TABLE No. 5—Continued.

COUNTIES.	VALUATION OF SCHOOL APPARATUS.	
	1874.	1875.
Alameda	$1,666 00	$1,459 00
Alpine	70 00	20 00
Amador	914 00	910 00
Butte	1,494 25	1,287 00
Calaveras	769 00	995 00
Colusa	927 00	1,212 10
Contra Costa	1,128 00	1,295 00
Del Norte	155 58	194 50
El Dorado	1,961 94	2,149 34
Fresno	200 00	658 10
Humboldt	542 00	947 50
Inyo	27 60	98 70
Kern	428 93	324 80
Klamath	50 00	....
Lake	275 39	425 00
Lassen	185 00	271 00
Los Angeles	2,100 00	2,246 00
Marin	1,125 00	757 00
Mariposa	572 00	657 00
Mendocino	1,012 33	1,387 01
Merced	5[illegible]3 50	716 00
Modoc	382 00	133 50
Mono	10 00	25 00
Monterey	744 50	873 75
Napa	846 50	976 00
Nevada	2,187 50	2,101 00
Placer	1,399 00	1,938 00
Plumas	706 50	830 82
Sacramento	1,799 12	1,799 12
San Benito	....	182 80
San Bernardino	199 82	200 00
San Diego	55 00	201 00
San Francisco	....	2,600 00
San Joaquin	928 55	1,000 00
San Luis Obispo	670 00	740 00
San Mateo	957 75	1,528 00
Santa Barbara	275 00	334 58
Santa Clara	1,866 00	2,689 00
Santa Cruz	815 00	1,095 00
Shasta	643 25	915 00
Sierra	525 00	500 00
Siskiyou	1,145 00	767 00
Solano	1,350 25	2,155 00
Sonoma	460 00	2,383 25
Stanislaus	533 00	976 73
Sutter	622 25	955 75
Tehama	637 00	725 00
Trinity	50 00	75 00
Tulare	165 60	353 75
Tuolumne	1,040 00	1,295 25
Ventura	60 00	255 00
Yolo	155 00	930 00
Yuba	1,315 68	1,290 68
Totals	$38,691 79	$50,785 27

TABLE No. 5—Continued.

COUNTIES.	TOTAL VALUATION OF SCHOOL PROPERTY.	
	1874.	1875.
Alameda	$279,800 00	$346,926 00
Alpine	1,167 50	568 00
Amador	23,190 00	30,137 50
Butte	58,945 66	78,368 75
Calaveras	20,045 20	23,526 49
Colusa	32,717 00	44,184 91
Contra Costa	47,938 87	50,800 00
Del Norte	6,785 93	7,231 19
El Dorado	29,226 53	35,269 84
Fresno	8,828 46	17,835 33
Humboldt	30,009 00	38,839 50
Inyo	6,741 36	6,892 07
Kern	10,354 15	8,085 80
Klamath	2,670 00	....
Lake	12,073 49	13,735 00
Lassen	9,359 50	10,546 25
Los Angeles	114,670 50	130,860 33
Marin	37,189 00	40,867 00
Mariposa	8,319 00	8,451 00
Mendocino	39,807 51	38,604 98
Merced	18,335 26	42,909 29
Modoc	5,184 25	6,369 15
Mono	2,070 00	2,325 00
Monterey	44,344 24	43,342 50
Napa	53,227 66	58,653 75
Nevada	97,415 17	103,142 00
Placer	38,856 00	47,573 00
Plumas	12,159 00	15,043 69
Sacramento	174,997 45	174,997 45
San Benito	....	25,691 57
San Bernardino	17,405 29	21,505 00
San Diego	12,826 75	14,072 00
San Francisco	2,227,620 00	2,369,600 00
San Joaquin	214,298 55	222,885 00
San Luis Obispo	12,137 83	15,962 42
San Mateo	45,172 22	59,608 00
Santa Barbara	31,982 00	45,566 76
Santa Clara	173,194 00	232,517 00
Santa Cruz	43,232 00	50,701 75
Shasta	15,527 75	15,817 00
Sierra	7,410 00	8,555 00
Siskiyou	26,637 50	25,470 00
Solano	93,658 50	105,090 00
Sonoma	60,102 35	133,702 48
Stanislaus	23,927 00	53,391 65
Sutter	30,249 25	30,830 25
Tehama	30,837 00	33,055 00
Trinity	4,309 00	5,072 00
Tulare	10,769 25	22,794 29
Tuolumne	19,768 00	20,696 02
Ventura	17,603 00	23,430 00
Yolo	38,200 00	53,257 00
Yuba	52,847 34	53,322 34
Totals	$4,436,142 27	$5,068,678 30

TABLE No. 6.

Statement, by counties, of apportionment of Public School Fund, for school years ending June thirtieth, eighteen hundred and seventy-four, and eighteen hundred and seventy-five.

COUNTIES.	Semi-annual.		Total for 1874.
	August, 1873.	March, 1874.	
Alameda	$5,326 72	$15,054 73	$20,381 45
Alpine	84 46	251 99	336 45
Amador	1,719 54	4,758 82	6,478 36
Butte	2,150 86	6,036 61	8,187 47
Calaveras	1,846 64	4,939 45	6,786 09
Colusa	1,339 06	3,759 78	5,098 84
Contra Costa	2,040 16	5,804 69	7,844 85
Del Norte	258 30	776 04	1,034 34
El Dorado	1,963 90	5,137 92	7,101 82
Fresno	758 50	2,352 65	3,111 15
Humboldt	1,589 98	4,591 57	6,181 55
Inyo	212 38	655 62	868 00
Kern	376 38	1,369 22	1,745 60
Klamath	211 56	615 48	827 04
Lake	820 00	2,276 83	3,096 83
Lassen	360 85	1,235 42	1,596 22
Los Angeles	5,061 86	13,605 23	18,667 09
Marin	1,231 64	3,144 30	4,375 94
Mariposa	717 50	2,131 88	2,849 38
Mendocino	2,025 40	5,367 61	7,393 01
Merced	744 56	2,067 21	2,811 77
Mono	71 34	200 70	272 04
Monterey	2,828 18	8,123 89	10,952 07
Napa	1,695 76	4,703 07	6,398 83
Nevada	3,426 78	9,263 42	12,690 20
Placer	1,827 78	4,830 18	6,657 96
Plumas	574 00	1,697 03	2,271 03
Sacramento	4,610 04	12,097 75	16,707 79
San Bernardino	1,298 06	3,483 26	4,781 32
San Diego	1,153 74	2,892 31	4,046 05
San Francisco	26,187 52	76,865 87	103,053 39
San Joaquin	4,000 78	10,278 07	14,278 85
San Luis Obispo	1,151 28	3,641 59	4,792 87
San Mateo	1,564 56	4,410 94	5,975 50
Santa Barbara	1,212 78	3,804 38	5,017 16
Santa Clara	5,277 52	15,079 26	20,356 78
Santa Cruz	2,210 72	5,969 71	8,180 43
Shasta	1,047 14	2,959 21	4,006 35
Sierra	827 38	2,185 40	3,012 78
Siskiyou	1,845 00	5,352 00	7,197 00
Solano	3,097 96	8,286 68	11,384 64
Sonoma	5,024 14	13,154 77	18,178 91
Stanislaus	1,236 56	3,817 76	5,054 32
Sutter	1,076 66	2,876 70	3,953 36
Tehama	941 36	2,662 62	3,603 98
Trinity	416 56	1,181 90	1,598 46
Tulare	1,241 48	3,904 73	5,146 21
Tuolumne	1,567 84	4,000 62	5,568 46
Ventura	674 04	2,089 51	2,763 55
Yolo	1,722 82	4,725 37	6,448 19
Yuba	1,977 84	5,318 55	7,296 39
Totals	$112,627 82	$315,790 30	$428,418 12

Table No. 6—Continued.

COUNTIES.	Semi-annual.		Total for 1875.
	August, 1874.	March, 1875.	
Alameda	$5,343 00	$57,046 80	$62,389 80
Alpine	63 05	673 18	736 23
Amador	1,493 05	15,941 18	17,434 23
Butte	2,031 90	21,694 44	23,726 34
Calaveras	1,495 00	15,962 00	17,457 00
Colusa	1,326 65	14,164 54	15,491 19
Contra Costa	1,853 15	19,785 94	21,639 09
Del Norte	272 35	2,907 86	3,180 21
El Dorado	1,591 20	16,989 12	18,580 32
Fresno	744 90	7,953 24	8,698 14
Humboldt	1,561 30	17,967 66	19,528 96
Inyo	207 35	2,213 86	2,421 21
Kern	493 35	5,267 46	5,760 81
Klamath	189 15	....	189 15
Lake	789 10	8,425 16	9,214 26
Lassen	430 95	4,601 22	5,032 17
Los Angeles	4,630 60	49,440 56	54,071 16
Marin	1,063 40	11,353 84	12,417 24
Mariposa	578 50	6,176 60	6,755 10
Mendocino	1,721 20	18,377 12	20,098 32
Merced	768 30	8,203 08	8,971 38
Modoc	629 20	6,717 92	7,347 12
Mono	67 60	721 76	789 36
Monterey	1,859 65	19,855 34	21,714 99
Napa	1,689 35	18,037 06	19,726 41
Nevada	2,945 80	31,452 08	34,397 88
Placer	1,576 90	16,836 44	18,413 34
Plumas	514 80	5,496 48	6,011 28
Sacramento	3,980 60	42,500 56	46,481 16
San Benito	870 35	9,292 66	10,163 01
San Bernardino	1,186 25	12,665 50	13,851 75
San Diego	1,123 20	11,992 32	13,115 52
San Francisco	24,760 45	264,365 42	289,125 87
San Joaquin	3,305 25	35,289 90	38,595 15
San Luis Obispo	1,197 95	12,790 42	13,988 37
San Mateo	1,374 75	14,678 10	16,052 85
Santa Barbara	1,246 70	13,310 92	14,557 62
Santa Clara	5,020 60	53,604 56	58,625 16
Santa Cruz	1,955 20	20,875 52	22,830 72
Shasta	957 45	10,222 62	11,180 07
Sierra	709 15	7,571 54	8,280 69
Siskiyou	1,038 05	11,804 94	12,842 99
Solano	2,879 50	30,744 20	33,623 70
Sonoma	4,241 90	45,290 44	49,532 34
Stanislaus	1,192 75	12,734 90	13,927 65
Sutter	960 70	10,257 32	11,218 02
Tehama	897 65	9,584 14	10,481 79
Trinity	387 40	4,136 24	4,523 64
Tulare	1,415 05	15,108 38	16,523 43
Tuolumne	1,264 25	13,498 30	14,762 55
Ventura	666 90	7,120 44	7,787 34
Yolo	1,562 60	16,683 76	18,246 36
Yuba	1,690 65	18,050 94	19,741 59
Totals	$103,816 05	$1,108,435 98	$1,212,252 03

TABLE No. 7.

Statistical table by years, showing the total expenditures for public schools in the State of California, from eighteen hundred and fifty-two to eighteen hundred and seventy-five, the assessable property of the State, and the percentage of expenditures on taxable property.

YEARS.	Assessed value of property.	YEARS.	Total expenditures.	Rate per each $100.
1850–51	$57,670,689 00	1851–52	$33,449 00	.0679
1851–2	49,231,052 00	1852–3	65,645 00	.1016
1852–3	64,579,375 00	1853–4	275,606 00	.2890
1853–4	95,335,646 00	1854–5	334,638 00	.3009
1854–5	111,191,630 00	1855–6	305,221 00	.2938
1855–6	103,887,193 55	1856–7	307,832 00	.3240
1856–7	95,007,440 97	1857–8	339,914 00	.2696
1857–8	126,059,461 82	1859	427,003 00	.3444
1858–9	123,955,877 00	1860	474,263 00	.3618
1859–60	131,060,279 49	1861	470,113 00	.3172
1860–61	148,193,540 02	1862	441,228 00	.2985
1861–2	147,811,617 16	1863	483,407 00	.3014
1862–3	160,369,071 81	1864	655,198 00	.3763
1863–4	174,104,955 07	1865	883,116 00	.4893
1864–5	180,484,949 85	1866	859,229 00	.4680
1865–6	183,509,161 00	1867	1,163,348 00	.5816
1866–7	200,764,135 50	1868	1,151,407 00	.5255
1867–8	212,205,339 01	1869	1,290,585 00	.5418
1868–9	237,483,175 07	1870	1,529,047 00	.5868
1869–70	260,563,886 08	1871	1,713,431 00	.6572
1870–71	277,538,134 97	1872	1,881,333 00	.7001
1871–2	267,868,126 76	1873	2,113,356 00	.3321
1872–3	637,232,823 31	1874	2,111,155 33	.3992
1873–4	528,747,043 00	1875	2,658,241 34	.4347
1874–5	611,495,197 00			

TABLE No. 8.

Statement by years, showing the total amount of receipts and expenditures for public schools of the State of California, from eighteen hundred and fifty-two to eighteen hundred and seventy-five, inclusive.

YEARS.	Total amount of the State School Fund apportioned.	Total amount raised by county and city taxes.	Total amount raised from other sources.
1852	....	....	$2,417 00
1853	....	....	10,626 00
1854	$52,061 00	$157,702 00	42,557 00
1855	63,662 00	119,128 00	39,395 00
1856	69,961 00	121,639 00	28,619 00
1857	78,057 00	148,989 00	55,035 00
1858	53,405 00	162,870 00	85,107 00
1859	72,319 00	205,196 00	97,534 00
1860	81,118 00	230,514 00	122,858 00
1861	81,461 00	241,861 00	114,397 00
1862	75,412 00	294,828 00	141,806 00
1863	145,537 00	328,554 00	68,209 00
1864	132,217 00	260,842 00	84,084 00
1865	168,828 00	390,306 00	91,181 00
1866	132,410 00	470,668 00	79,600 00
1867	268,910 00	595,718 00	81,966 00
1868	252,603 00	654,738 00	73,986 00
1869	290,796 00	847,229 00	66,531 00
1870	360,447 00	839,756 00	63,441 00
1871	423,853 00	923,809 00	46,660 00
1872	424,022 00	1,249,943 00	232,075 00
1873	430,220 00	1,541,597 00	310,502 00
1874	428,418 12	1,332,208 82	345,316 95
1875	1,212,252 03	1,115,530 06	676,259 64
Totals	$5,298,869 35	$12,243,625 88	$2,960,162 59

TABLE No. 8—Continued.

YEARS.	Total amount paid for teachers' salaries.	Total amount paid for school houses and sites.	Total amount expended for school purposes.
1852	$20,707 00	$9,775 00	$33,449 00
1853	47,894 00	6,193 00	65,645 00
1854	85,860 00	129,677 00	275,606 00
1855	181,906 00	76,525 00	334,638 00
1856	200,941 00	52,484 00	305,221 00
1857	192,613 00	59,743 00	307,832 00
1858	204,545 00	88,199 00	339,914 00
1859	256,777 00	90,266 00	427,003 00
1860	311,165 00	110,352 00	474,263 00
1861	311,501 00	101,818 00	470,113 00
1862	330,249 00	49,274 00	441,238 00
1863	328,338 00	93,931 00	483,407 00
1864	411,101 00	167,393 00	656,198 00
1865	526,585 00	257,804 00	883,116 00
1866	551,462 00	185,056 00	859,229 00
1867	696,110 00	238,010 00	1,163,348 00
1868	763,639 00	221,118 00	1,151,407 00
1869	873,814 00	205,766 00	1,290,585 00
1870	976,938 00	339,362 00	1,529,047 00
1871	1,103,125 00	390,158 00	1,713,431 00
1872	1,282,799 00	290,119 00	1,881,333 00
1873	1,434,367 00	374,069 00	2,113,356 00
1874	1,560,830 00	192,467 00	2,111,155 00
1875	1,810,480 00	421,279 00	2,658,241 00
Totals	$14,463,846 00	$3,950,828 00	$21,967,775 00

TABLE No. 9.

Statistical summary, by years, of the public schools of California, from eighteen hundred and fifty-one to eighteen hundred and seventy-five, inclusive.

YEARS.	Number of children listed by Census Marshals.	No. of children enrolled on School Register.	Average daily attendance.	Number of schools.
1851	* 5,906	1,846	....	49
1852	* 17,821	3,314	....	20
1853	* 19,442	4,193	2,020	111
1854	* 20,075	9,746	4,635	168
1855	* 26,077	....	6,442	227
1856	* 30,039	....	8,495	321
1857	* 35,722	17,232	9,717	368
1858	* 40,530	19,822	11,183	432
1859	* 48,676	23,519	13,364	523
1860	* 57,917	26,993	14,754	593
1861	* 68,395	31,786	17,804	684
1862	* 71,821	36,566	19,262	715
1863	* 78,055	36,540	19,992	754
1864	* 86,031	47,588	24,794	832
1865	* 95,067	50,089	29,592	947
1866	† 84,179	50,273	....	913
1867	† 94,213	62,227	....	1,083
1868	† 104,118	‡ 65,828	‡ 43,681	1,228
1869	† 112,743	‡ 73,754	‡ 49,802	1,354
1870	† 121,751	‡ 85,808	‡ 54,271	1,492
1871	† 130,116	‡ 91,332	‡ 64,286	1,550
1872	† 137,351	‡ 94,720	‡ 65,700	1,654
1873	† 141,610	‡ 107,593	‡ 69,461	1,868
1874	‖ 159,717	‖ 120,240	‖ 72,283	2,005
1875	§ 171,563	§ 130,930	§ 78,027	2,190

* Between four and fifteen years of age.
† Between five and fifteen years of age.
‡ Including children over fifteen years of age.
‖ Between five and seventeen years of age.
§ Including children over seventeen years of age.

Table No. 9—Continued.

YEARS.	Number of teachers.	Number of children under five years of age.	Number of census children in private schools
1851			
1852			
1853			
1854	214		
1855	301		
1856	392		
1857	486		
1858	517	¶23,558	
1859	744	¶28,300	
1860	831	¶30,932	5,438
1861	932	¶35,334	6,306
1862	962	¶38,127	6,886
1863	919	¶39,081	9,158
1864	1,079	¶41,323	11,359
1865	1,155	¶42,733	12,478
1866	1,268	52,037	15,671
1867	1,389	52,975	14,026
1868	1,590	58,119	14,820
1869	1,687	57,983	16,273
1870	1,869	62,940	16,198
1871	2,052	66,292	15,524
1872	2,301	69,723	13,787
1873	2,336	70,086	12,507
1874	2,452	74,876	14,149
1875	2,693	78,650	15,021

¶ Under five years of age.

TABLE No. 10.

Condition of the School Fund for the twenty-fifth and twenty-sixth fiscal years.

SCHOOL FUND.

Dr.					Cr.
July 8, 1873	To California Teacher	$4,200 00	July 1, 1873	By balance	$89,915 69
June 30, 1874	To warrants issued to County Treasurers	494,309 20	July 11, 1873	By interest on bonds	42,780 00
June 30, 1874	To balance	63,158 62	Jan. 8, 1874	By interest on bonds	44,280 00
			June 30, 1874	By receipts from counties	384,692 13
		$561,667 82			$561,667 82
June 30, 1875	To California Teacher	$4,482 00	July 1, 1874	By balance	$63,158 62
June 30, 1875	To warrants issued to County Treasurers	1,210,765 04	June 30, 1875	By interest on bonds	96,360 00
June 30, 1875	To balance	162,948 15	June 30, 1875	By receipts	1,218,676 57
		$1,378,195 19			$1,378,195 19
			July 1, 1875	By balance	$162,948 15

TABLE No. 10—Continued.

STATE SCHOOL FUND.

Dr.			Cr.		
June 30, 1874	To warrants issued	$146,055 85	July 1, 1873	By balance	$30,423 59
June 30, 1874	To balance	70,382 63	June 30, 1874	By receipts	186,014 89
		$216,438 48			$216,438 48
June 30, 1875	To warrants issued	$197,936 87	July 1, 1874	By balance	$70,382 63
June 30, 1875	To balance	30,644 80	June 30, 1875	By warrants canceled	468 12
			June 30, 1875	By receipts from counties	157,730 92
		$228,581 67			$228,581 67
			July 1, 1875	By balance	$30,644 80

TABLE No. 11.

Statement of the bonds held in trust by the State Treasurer for the School Fund.

Bonds.	Amount.
State Capitol Bonds of 1870, seven per cent	$236,000 00
State Capitol Bonds of 1872, seven per cent	115,000 00
Funded debt of 1873, six per cent	1,386,500 00
Total	$1,737,500 00

TABLE No. 12.

List of County Superintendents whose term of office expires the first Monday in March, eighteen hundred and seventy-six, and their Post Offices.

Counties.	Names.	Post Office.
Alameda	Rev. W. F. B. Lynch	East Oakland.
Alpine	R. C. Montgomery	Monitor.
Amador	W. H. Stowes	Plymouth.
Butte	Samuel T. Blake	Chico.
Calaveras	E. F. Walker	San Andreas.
Colusa	A. Thurber	Pacheco.
Contra Costa	J. E. Putnam	Colusa.
Del Norte	Max Lipowitz	Crescent City.
El Dorado	John P. Munson	Placerville.
Fresno	Rev. T. O. Ells, Sr.	King's River.
Humboldt	E. C. Cummings	Rohnerville.
Inyo	J. W. Symmes	Independence.
Kern	L. A. Beardsley	Bakersfield.
Lake	Louis Wallace	Lakeport.
Lassen	Z. N. Spalding	Susanville.
Los Angeles	George H. Peck	El Monte.
Marin	Samuel Saunders	San Rafael.
Mariposa	David Egenhoff	Mariposa.
Mendocino	J. H. Seawell	Ukiah City.
Merced	B. F. Fowler	Merced.
Modoc	W. F. Estes	Centerville.
Mono	E. R. Miner	Benton.
Monterey	R. C. McCroskey	Salinas City.
Napa	Rev. G. W. Ford	Napa.
Nevada	Frank Power	Nevada City.
Placer	John T. Kinkade	Auburn.
Plumas	W. S. Church	Quincy.
Sacramento	Dr. G. R. Kelly	Sacramento.
San Bernardino	Henry Goodcell, Jr.	San Bernardino.
San Diego	J. H. S. Jamison	North San Diego.
San Francisco	James Denman	San Francisco.
San Joaquin	T. O. Crawford	Stockton.
San Luis Obispo	James M. Felts	Cambria.
San Mateo	C. G. Warren	Redwood City.
Santa Barbara	Rev. J. C. Hamer	Santa Barbara.
San Benito	H. Z. Morris	Hollister.
Santa Clara	J. G. Kennedy	San José.
Santa Cruz	W. H. Hobbs	Soquel.
Shasta	G. W. Welch	Shasta.
Sierra	A. M. Phalin	Port Wine.
Siskiyou	William Duenkel	Yreka.
Solano	C. W. Childs	Suisun City.
Sonoma	A. C. McMeans	Santa Rosa.
Stanislaus	James Burney	Modesto.
Sutter	M. C. Clark	Yuba City.
Tehama	Charles D. Woodman	Red Bluff.
Trinity	Hiram H. Bragdon	Weaverville.
Tulare	R. P. Merrill	Porterville.
Tuolumne	John Murnan	Sonora.
Ventura	F. S. S. Buckman	San Buenaventura.
Yolo	G. N. Freman	Woodland.
Yuba	Th. H. Steel	Marysville.

TABLE No. 13.

List of County Superintendents taking office the first Monday in March, eighteen hundred and seventy-six, and their present Post Offices.

Counties.	Names.	Post Office.
Alameda	Rev. W. F. B. Lynch	East Oakland.
Alpine	Miss Charlotte M. Pitcher	
Amador	W. H. Stowes	Plymouth.
Butte	Arthur McDermott	Oroville.
Calaveras	Charles R. Beal	San Andreas.
Colusa	Samuel Houchins	Princeton.
Contra Costa	A. Thurber	Pacheco.
Del Norte	Max Lipowitz	Crescent City.
El Dorado	John P. Munson	Placerville.
Fresno	R. H. Bramlet	Fresno.
Humboldt	E. C. Cummings	Rohnerville.
Inyo	John W Symmes	Independence.
Kern	L. A. Beardsley	Bakersfield.
Lake	Louis Wallace	Lakeport.
Lassen	S. A. Doyle	Janesville.
Los Angeles	Thomas A. Saxen	Los Angeles.
Marin	Samuel Saunders	San Rafael.
Mariposa	Richard Kane	Mariposa.
Mendocino	John C. Ruddock	Ukiah.
Merced	B. F. Fowler	Merced.
Modoc	W. T. Estes.	Centerville.
Mono	Miss Alice Walker	Bridgeport.
Monterey	R. C. McCroskey	Salinas City.
Napa	L. Fellers	Napa City.
Nevada	E. M. Preston	Nevada City.
Placer	Eugene Calvin	Auburn.
Plumas	W. S. Church	La Porte.
Sacramento	F. L. Landis	Sacramento.
San Benito	H. Z. Morris	Hollister.
San Bernardino	Charles R. Paine	San Bernardino.
San Diego	F. N. Pauly	San Diego.
San Francisco	H. N. Bolander	San Francisco.
San Joaquin		
San Luis Obispo	J. M. Felts	Cambria.
San Mateo	G. P. Hartley	Spanishtown.
Santa Barbara	G. E. Thurmond	
Santa Clara	E. Rousseau	Santa Clara.
Santa Cruz	W. H. Hobbs	Soquel.
Shasta	Mrs. D. M. Coleman	Shasta.
Sierra	A. M. Phalin	Port Wine.
Siskiyou	William Duenkel	Yreka.
Solano	C. W. Childs	Suisun City.
Sonoma	A. C. McMeans	Santa Rosa.
Stanislaus	W. B. Howard	Modesto.
Sutter	M. C. Clark	Yuba City.
Tehama	E. S. Campbell	
Trinity	Mary N. Wadleigh	Junction City.
Tulare	R. P. Merrill	Portersville.
Tuolumne	Rose R. Morgan	Columbia.
Ventura	F. S. S. Buckman	San Buenaventura.
Yolo		
Yuba	Th. H. Steel	Marysville.

EXTRACTS

FROM

THE REPORTS OF COUNTY SUPERINTENDENTS.

[In preparing these extracts for printing, I have occasionally made changes to improve the connection of sentences and the general sense of the remarks.]

ALAMEDA COUNTY.

W. F. B. LYNCH..................................Superintendent.

The schools of the county are in a prosperous condition. Owing to the great increase in the State School Fund, all our schools, four excepted, have been enabled to continue in session eight months, and many of them a much longer time. Nearly all our schools are graded, and will compare favorably with any of the schools of the State.

ALPINE COUNTY.

R. E. MONTGOMERY................................Superintendent.

The schools are in a prosperous condition, more especially the Clay School. The only drawback is that the teachers are compelled to teach at starvation prices; therefore first-class teachers cannot be obtained.

An amendment to an Act approved March twenty-eighth, eighteen hundred and seventy-four, entitled "An Act to enforce the educational rights of children." The amendment shall read: Every parent, guardian, or other person, in the State of California, having control and charge of any child or children between the ages of eight and fourteen years, shall be required and *compelled* to send them to *school* during *one third* of each year, or four consecutive months. If they are too poor to clothe and board their children from home (as many would be obliged to do),

then the child or children must be clothed and boarded at the expense of the county.

BUTTE COUNTY.

H. T. BATCHELDER.................................Superintendent.

The schools of Butte County have, during the year, shown a steady increase in the number of pupils, thus creating a greater demand for school room and more efficient teachers. Both of these wants have, as far as practicable, been supplied, there having been almost forty thousand dollars expended in the county for building purposes; and several new teachers, with certificates of high grades and with large experience, have presented themselves to supply the second want. Also, many of our home-teachers have successfully applied for certificates of a higher grade. I believe that the citizens of Butte County are becoming thoroughly aroused to the vast importance of a common school education. They show their appreciation of our public schools by patronizing them liberally. Private schools in Butte County are a failure; they cannot compete with our public schools.

CALAVERAS COUNTY.

E. F. WALKER.......................................Superintendent.

The new financial arrangement of the public school funds has put new life into our little mountain districts, and there is no doubt but that the condition of our schools has already been greatly benefited by it; and we can safely predict that the progress now made under the improved facilities, if permitted by our law-makers to continue, will prove of the greatest possible advantage to large numbers who can receive little or no education except from the free school system, under the present financial arrangement. I believe a large majority of the people of this county are strongly opposed to the proposed change of text-books every four years.

COLUSA COUNTY.

J. E. PUTNAM...Superintendent.

The schools of Colusa County are, with a very few exceptions, in a flourishing condition. I think we have as good a class of teachers as any county in the State. I would suggest that the school law be so amended that the School Trustees be elected earlier in the season, as the present time for election is a very busy one, and the result is, in Colusa County, no elections are held in at least one half of the districts.

CONTRA COSTA COUNTY.

A. THURBER..Superintendent.

The progress of our public schools during the past year has not been as good as could be desired; yet, considering the difficulties under which the teachers labor, it has been as good, perhaps, as could be expected. Too much is required of our teachers; too many branches are crowded into the schools. The attainments of the pupils are becoming more and more superficial. Sufficient time cannot be devoted to class recitation to produce good results. A practical examination of any of our mixed country schools, aside from the text-books, will most conclusively prove that the present system of grading and "course of study" is not producing as good results as it was claimed it would. Clause four of section one thousand eight hundred and fifty-eight, California School Law, should be amended, so that all school moneys remaining on hand after apportioning five hundred dollars to each teacher, etc., must be apportioned pro rata to all the census children in the county. As the law now stands, a district having fifty-one census children in this county has received three hundred and ninety-five dollars more than one having forty census children. This great difference should be equalized if possible.

DEL NORTE COUNTY.

MAX LIPOWITZ.......................................Superintendent.

The condition of the public schools of Del Norte County has greatly improved during the past year. Higher salaries were paid to teachers in most of the districts, and, for this reason, superior teachers were secured. * * * Superior furniture was, during the past year, purchased for the schools of two districts.

The following suggestions for amending the school law of this State are respectfully submitted: 1. Five per cent of the State School Fund, not to exceed fifteen dollars, to be annually set apart for the purchase of school apparatus. 2. Five per cent of the State School Fund, not to exceed thirty-five dollars, to be annually set apart for the purchase of library books. 3. A minimum rate of teachers' salaries to be established by law, based upon the grade of the certificate and the number of years of experience in teaching. 4. The text-books to be furnished free to *all* pupils in the same manner as stationery now is supplied. * * * 6. That the special statute now in force, making the salary of the County Superintendent of Del Norte one hundred and fifty dollars, be so amended as to read "two hundred and fifty dollars and actual traveling expenses."

EL DORADO COUNTY.

Jno. P. Munson.....................................Superintendent.

The public schools of the county are in a fair condition. The increased amount of money for educational purposes has been the means of enabling the schools to be open for nearly double the time of former years. Two new school houses have been built in districts comprising portions of El Dorado County.

FRESNO COUNTY.

T. O. Ellis, Sr.....................................Superintendent.

The embarrassment under the new law is worse in some instances than under the old law. The small districts struggle to maintain a six months school, and the larger ones teach from eight to eleven and a half months, and have a balance sufficient, in some instances, more than enough to support an eight months' school. It is the sincere opinion of the writer that eight hundred dollars should have been given to all districts, and the balance, if any, divided among all districts pro rata, and every district should be required to maintain at least an eight months' school.

HUMBOLDT COUNTY.

E. C. Cummings.....................................Superintendent.

The months of April, May, and June were mostly spent by me in visiting the schools in the county which were in session during those months, and in nearly all of them I found the teachers doing good work and the pupils making satisfactory progress in their studies. The present method of apportioning the school funds, I find, is of great benefit to many of our districts, as a goodly number are now enabled to maintain a six months' school, which formerly could have but three or four months during the year. We have been laboring under great disadvantage by not having a sufficient number of teachers to supply the schools. I believe at *no* time were *all* the schools in session during the year, and the result was that a few districts failed to maintain a six months' school, but they ought not to lose anything thereby, as it was not the fault of the school officers, as they used due diligence in getting teachers. I believe that our schools in this county will compare very favorably with schools of like grade elsewhere.

INYO COUNTY.

J. W. Symmes.....................................Superintendent.

Give us the old school law, *i. e.*, as it was before the last session of the Legislature. We have had the five hundred dollar limit long enough,

and do not like the arrangement of paying so much money into the State Treasury, and drawing only a portion of it back again.

KERN COUNTY.

L. A. Beardsley.....................................Superintendent.

Our schools have increased rapidly in size and interest during the past year. Three new districts have been formed, and five new school houses will probably be erected during the present school year. The new school law wrought a hardship in two of our districts, which reached nearly, but not quite, fifty census children. However, I believe that, on the whole, the law is a good one.

LAKE COUNTY.

Louis Wallace.....................................Superintendent.

I think I can see a decided improvement in our schools during the year. We have a better class of teachers; our terms of school have been lengthened; we have had a number of new districts organized; five new school houses have been built, with the probability of eight or ten more during the coming year. I would suggest the repeal of the latter part of section one thousand five hundred and seventy-seven of the school law, in regard to changing the boundaries of districts. That should be left altogether with the Board of Supervisors. Section one thousand five hundred and ninety-four should be repealed, and the County Superintendent authorized to appoint the Trustees of new districts. Section seventeen hundred and twenty-nine should be amended so as to supply each County Superintendent with two copies of the *California Teacher*, instead of one. Section one thousand eight hundred and forty-two should be amended so that in case the Assessor or Collector does not qualify within the specified time, that the Trustees may make an appointment to fill said vacancy. Section one thousand eight hundred and fifty eight should be so altered that districts having less than ten children may receive some public money. Section one thousand eight hundred and fifty-nine needs reconstruction, as it is often impossible for a new district to have an eight months' school in the year, and in such cases it is often difficult for the old district to have six months school. Our method of grading schools should be altered. As it is now, we have not a single third grade school in the county. A third grade certificate is of no use whatever, except to assistants in some of the larger schools. In fact, there are only three positions that can be held by third grade teachers. I think, also, that appropriations should be made for the establishment of one High School in each county, open to all children in the county. Such a provision would be of great advantage to us.

LOS ANGELES COUNTY.

Geo. H. Peck..Superintendent.

The schools of Los Angeles County are improving. County Treasurers should be compelled by law to report in writing at the end of each month to County Superintendents the amounts placed to Superintendent's credit during the month [moneys received for the school fund?]

MARIPOSA COUNTY.

David Egenhoff..Superintendent.

I take pleasure in being able to report the condition of public schools in this county as very satisfactory, and can offer no suggestion or recommendation in relation to altering or amending the law and regulations which now govern the system of public schools in this State. Its workings have thus far proven eminently satisfactory to all concerned, and the progress of the schools in this county is all that could be desired under the circumstances.

MENDOCINO COUNTY.

J. H. Seawell..Superintendent.

The schools in this county are generally in good condition. The new system of apportionments as enacted by the last Legislature is a decided improvement [upon the old pro rata system]. Small districts, which under the old system of apportionments only received one hundred and fifty dollars or two hundred dollars, now receive five hundred dollars, a sufficient amount of money to maintain a six or seven months school.

MERCED COUNTY.

B. F. Fowler..Superintendent.

Our schools, I think, are in a far better condition than when last reported, though the number of census children in the county have not increased during the past year. I find that the average number belonging to the schools is larger, and that the average daily attendance has increased during the past year. I also find that a large percent of children have not attended any public school during the year. This is a deplorable state of affairs, and how to remedy the matter is more than the best of us can tell. Our compulsory education law, in sparsely settled districts, is almost a dead letter generally, there being so few that come within its reach. I wish the distance could be extended to *two* miles, instead of as it now stands, "one mile" by the nearest traveled road. I think section one thousand eight hundred and fifty-eight, subdivision three, should be amended to read as follows: "Six hundred dollars shall be apportioned to every teacher assigned each district," etc. Subdivision four of the same section amended to read as follows: "All school moneys remaining on hand after apportioning six hundred dollars (instead of five) to each district having fifteen census children or more, for every teacher assigned it, and after apportioning *four hundred dollars* to districts having less than fifteen census children, must be apportioned to the several districts in proportion to the number of census children in each district." By apportioning the excess to the larger districts exclusively, as now done, it helps those that are the best able to help themselves, whilst the smaller districts, to continue school, must be subjected to an onerous tax per child, or vote a tax and collect it, which is generally expensive in the extreme, as lawyers and collectors generally secure the "lion's share."

MONTEREY COUNTY.

R. C. McCroskey......................................Superintendent.

The condition of the schools of this county this year is quite an improvement over what it was last year. The Trustees have manifested more care in selecting teachers, have been more exacting in their demands, and more careful in complying with the provisions of the school law. Public schools are in great favor in this county, the people not even murmuring at the high rate for school tax last year. Much is yet to be done, as the condition of the schools is not what our admirable system would seem to warrant.

NAPA COUNTY.

G. W. Ford..Superintendent.

The year past was one of unparalleled energy and interest in the public schools of the county. There has been raised money enough by the county tax, with the State apportionment, to keep all the schools running six months, and many of them seven, eight, and even ten months within the school year; besides, all the districts that were in debt have paid off their debts by subscription or district taxes. Now all the districts but four have a surplus on hand at the close of the school year. We have been fortunate in securing, with very few exceptions, good and efficient teachers to take charge of the schools; but, unhappily, the teachers stay in one place not long enough to become acquainted with the capacity and wants of their pupils, and to adopt their teaching to such wants.

PLACER COUNTY.

Frank Powers..Superintendent.

Our schools were never in so satisfactory a condition as at present; but the manner of apportioning school moneys is not improved, so far as small or sparsely populated districts are concerned. Five hundred

dollars per teacher, less twenty or thirty dollars for Library Fund, is entirely inadequate. I think six hundred dollars should be allowed per teacher; or, after first apportioning five hundred, apportion the overplus, pro rata among all the census children, instead of only among districts having not less than fifty census children. Make the compulsory education law uniform and effective, or repeal it.

PLUMAS COUNTY.

W. S. CHURCH.......................................Superintendent.

The schools in this county, generally speaking, have done well this school year and have made considerable progress. The working of the schools under the provisions of the Tuttle School Bill is an improvement on the old system. But still I think the larger districts get too much money, and the smaller districts too little. The smaller districts should have at least six hundred dollars where they now get five hundred. Most of the small districts are in better spirits over their school matters than formerly, as the present provisions for school funds gives them encouragement to do more for their schools. Unless the Trustees of a district employ a teacher by December thirty-first of each year, the law should be so amended as to give the Superintendent power to do it. The reason is self-evident.

SAN BERNARDINO COUNTY.

HENRY GOODCELL, JR.............................Superintendent.

The condition of the public schools in this county, at the close of the present school year, is more gratifying than it has been at the close of any preceding school year. The increased amount of school fund, together with its more equable distribution, has given a new impetus to our schools, and has enabled many of the districts to maintain better schools and longer terms than have heretofore been practicable. Three new school houses have been built, all of which are creditable to the districts. Two districts have furnished their school rooms with improved patent school desks. In a few districts money has been raised, by subcription, for repairs, etc. The schools are all using, exclusively, the State series of text-books, and they are more nearly graded according to the State course than at any previous time. I am a friend of Institutes, and I trust that the provision made for holding them will continue a part of our school law. If properly conducted, they cannot fail to be profitable to the teachers, and, therefore, to the schools. If they are not in all cases what they should be, I would rather persevere in making them what they ought to be than to abolish them. If there be any attempt, however, to require or enforce the attendance of teachers, I think it would be well to make the requirement a little more definite, and to fix a penalty for its non-observance.

SANTA BARBARA COUNTY.

J. C. HAMER..Superintendent.

The present mode of apportioning school money is unjust, discriminating against small districts, as will be seen by observing the large balance of funds now held by large districts. This law ought to be repealed at the next session of the Legislature. Amend the school law so that the State Board of Education cannot change the text-books oftener than every ten years. The State course of studies is too voluminous, and can only be taught superficially in the schoo s. The number of studies must be reduced to make it practical.

SANTA CLARA COUNTY.

J. G. KENNEDY.......................................Superintendent.

The schools of Santa Clara County were never in a more flourishing condition than at the present moment. Nearly every district commences the new school year with a large balance in the treasury. This arises from two causes: First—The large increase in the State tax. Second—The increase of county money. The schools of this county are working as near as possible on the course of study. First grade schools are rapidly on the increase, and by another year two thirds of the schools will be first grades, and the remainder, nearly all second grades.

Changes in School Law—First, have teachers certificates of two grades only; second grade good for four years, and first grade good for life. In fact, my preference would be to have all certificates granted for life. Second, modify examinations so as to give examiners more discretionary power in granting certificates. Third, amend school law so as to give all districts a pro rata of school funds remaining after giving five hundred dollars to each teacher allowed.

SANTA CRUZ COUNTY.

W. H. HOBBS..Superintendent.

I would advocate the following changes in our School Law:

1st. County Institutes should be held by the State Superintendent, assisted by a corps of Institute Instructors. 2d. County Superintendents should have power to grant temporary certificates to persons not holding certificates from other counties. 3d. Examination of teachers should take place the last week in March, June, September, and December, instead of the first. 4th. County Superintendents in first and second class counties should devote the whole time to the duties of the office, and be paid accordingly.

SHASTA COUNTY.

G. W. WELCH..Superintendent.

Compared with the standing of our schools last year, we find a marked improvement in the ratio of attendance, length of time school was taught, and the consequent advancement of the scholars in their studies. Ample means were provided by the State for an eight months school in the sparsely settled districts, but this system of distributing the funds was not as satisfactory to the more populous—the Board of Supervisors of this county having established six more districts, and levied a tax of twenty and one tenth cents per one hundred dollars, which is less than three dollars per census child. The same action was taken, if I do not err, in other counties; the tendency of which seems to be to strengthen the smaller districts and to weaken the larger ones, and force the latter to submit to a district tax if they desire to keep up their higher graded schools. I would, therefore, suggest another mode of distributing the State aid, to wit: The whole State school money to be divided in equal parts and subdivided as follows: Part first is divided equally amongst all the census children of the State between five and seventeen years of age. Part second is divided in accordance with the number of teachers in the State—ratio from thirty to one hundred pupils to a teacher. Part third to be divided in accordance with the average daily attendance of scholars during the preceding school year; number of school months to be not less than six, in any one district participating.

An alteration in the present system of examining teachers would, undoubtedly, be to the benefit of the communities who are forced to pay high salaries to but inferior talent; and I would suggest as follows: The State Board of Examination shall have the power to appoint three first grade teachers in each county, to act with the Superintendent as Chairman, as a Board of Examiners for such county; their sessions to be held at any time when three or more applications are filed with the Superintendent, but not oftener than four times during any one year; they are authorized to issue only *Third Grade Certificates*, good for one year, and may renew the same for one year more, according to their discretion. Compensation for their services as such Board to be paid out of the General Fund of the county by the Board of Supervisors, and the whole expenses in any one year not to exceed two hundred dollars. Applicants for higher grades have to apply to the State Board of Examination, consisting rather of the present members, or of five first-class teachers chosen by the State Superintendent from the State at large. This Board shall hold their sessions twice a year in some central point of the State, and shall, after strict examination, have the right to grant First Grade or Life Certificates; Second Grade, good for a term of ten years; and Third Grade, good for a term of five years, over the whole State. Graduates of the State Normal School and the State University to receive diplomas of the same grade they hold, without examination. Expenses of this Board to be paid by the State, in the same manner as the compensation of the present Board of Examination is paid.

SIERRA COUNTY.

A. M. PHALIN..Superintendent.

I think the schools in Sierra County have derived nearly as much benefit within the last year as any two years heretofore. Cause, giving small districts a fair opportunity. Five hundred dollars to districts should not be changed. Think it would be well after districts have received five hundred dollars, if the remainder were divided among districts having not less than thirty-five census children in place of fifty.

SISKIYOU COUNTY.

WILLIAM DUENKEL..Superintendent.

The progress and condition of a school depends upon the qualification of the teacher. I have tried to get rid of the poor material as much as was in my power, substituting experienced teachers, and sincerely believe that a little improvement has been made. With regard to the special law for apportioning school money, I believe it worked very well. Two amendments, however, are necessary: first, to provide that no district shall receive an amount less than four hundred dollars; and, second, to provide that no district shall receive a greater amount of money than a district with a larger number of census children. The law in regard to teachers attending the Institute (section one thousand five hundred and sixty) is not strict enough, as most of the teachers only intend to gratify their taste for pleasure, and under such circumstances the money expended is squandered. A large number of teachers in this county have no experience in teaching. The Institute gives them opportunity to improve, but how is this abused! I would, therefore, suggest that a penalty be set for any teacher who does not attend during the prescribed hours, viz: that no teacher shall be allowed a salary who does not receive from the County Superintendent a certificate of attendance.

SOLANO COUNTY.

C. W. CHILDS..Superintendent.

Our schools are increasing in interest and public favor every year. It is gratifying to be able to report the existence of a higher standard of qualifications among the teachers employed in this county. I have graded the schools according to the plan proposed by the State Board, and our schools are now much more efficient.

STANISLAUS COUNTY.

JAMES BURNEY...Superintendent.

Within the last three years the number of public schools in this county has increased from thirty-one to forty-six. All the districts have maintained free schools for six months or more during the past year, and some as long as eleven months. Eighty-seven per cent of all the children between five and seventeen years of age have attended school during the past year. All the districts but two have balances of cash on hand of last year's money, and but one district has any outstanding debt. The time for holding school elections is most unfavorable for the farming counties. The last Saturday in June is in the midst of harvest. The present method of apportioning school money to the districts is certainly unjust. A district having fifty pupils receives about twice the amount that that one that has forty-nine pupils receives. I do not think that applicants for second or third grade certificates should be required to stand an examination on the higher branches, and I do think that the standard of proficiency should be as high for them, on the branches they are required to teach, as for higher grades. I think there should be many changes made in the manner of examining applicants for teachers' certificates, as other qualifications are necessary for a teacher than only a knowledge of the branches he is required to teach. Many possess knowledge who cannot impart it. Some possess knowledge and have the faculty of imparting it, and still lack other very necessary qualifications of a teacher. Such deficiencies no Board of Examination can detect in a three days' examination, during which time the examinee is all the time writing. I think, if it can be done, that teachers should secure their certificates from a Normal School, or some other source, where the party giving the certificate has had a more thorough acquaintance with the various qualifications or disqualifications of the applicant.

SUTTER COUNTY.

M. C. CLARK...Superintendent.

The schools of this county are, as a general thing, in a fair condition, and their progress, during the last year, has been quite satisfactory. More interest is being manifested by the patrons of our schools. Not less than five or six school houses will be built in the county during the school year ending eighteen hundred and seventy six. There is a general waking up in regard to education, and the people freely give of their substance for the support of public schools. I would suggest that the school law be amended in regard to the time of election of Trustees—the last Saturday in April being more convenient for all agricultural districts. The last Saturday in June is in the midst of harvesting, when people cannot and will not leave their work to attend to a school election.

TEHAMA COUNTY.

C. D. WOODMAN...Superintendent.

During the past year a marked improvement has taken place in our schools. The scarcity of teachers in the early part of the year prevented several of the districts from having as long a term as was desired. This year with increased number of teachers that have come into the county, I hope to start all schools in time to run an eight months term. The new mode of apportioning the school funds works well in this county, and I see no need of a change. I would suggest a change in the law fixing the days for the commencement of the examinations. I think that Mondays should take the place of Wednesdays. I find that it is almost impossible to get through with the examination during the four days of the week without holding night sessions, a rather severe tax on the strength of the applicants. I believe that nearly all the applicants that have failed to pass a successful examination in this county have done so from want of time.

TRINITY COUNTY.

H. H. BRAGDON...Superintendent.

The schools in this county are in as good condition as can be expected under the circumstances. Several of the districts extend over a large territory, giving only a part, and in a few districts only a small part of the scholars the privilege of attending. The teachers have been earnest and faithful, and the scholars are advancing. Three new districts have been formed within the school year. Two of them are situated more than twenty miles each from any other school, the other about six miles. All three were very much needed. We feel grateful for the liberal supply of [State School] funds, and we intend that every dollar of the money shall be judiciously expended.

TULARE COUNTY.

R. P. MERRILL...Superintendent.

There has been some improvement in the schools in Tulare County, and will be more during the present year, from the fact that the county is settling up rapidly with families from other and older countries, and also from the East; these families appreciate good schools. I will suggest that outside the cities we have no Trustees, but let the County Superintendent do their duty, as he has it to do [now anyhow.]

VENTURA COUNTY.

F. S. S. BUCKMAN.................................Superintendent.

The public schools of Ventura County have kept equal pace with the progress of all its other interests. We have a very competent class of teachers in the county, and unitedly they have succeeded in creating interest in the educational affairs of the county. One fine school house, at Pleasant Valley District, has been built during the year, at a cost of two thousand dollars.

YOLO COUNTY.

G. N. FREMAN.......................................Superintendent.

The schools of this county are in good working order, although many new school houses should be built, and better and increased facilities offered, in order to secure a better attendance and more rapid progress. Within the past year, four new school houses have been built, and two more are in course of erection. There has been a constant increase in our census pupils in almost all the school districts in the county. The Supervisors of our county have favored a liberal tax for school purposes, and with sufficient means and competent and experienced teachers, the schools are, for the most part, gradually gaining in interest and efficiency. Many parts of our county not being first-class agricultural land, are but sparsely settled, not having sufficient pupils to have good schools; but wherever there are plenty of children the schools are good. We heartily approve of the action of the Board of Education in the matter of grading our schools. This is a work of time, and in rural districts it is next to impossible to require that a teacher's certificate must be equal to the grade of the school, and especially is this apparent when the grade of a single pupil fixes the grade of the school.

YUBA COUNTY.

T. H. STEEL...Superintendent.

The public schools of Yuba County have never been in so prosperous a condition as at the present time. It has been my custom while visiting schools, and advising teachers, to endeavor to impress upon the minds of the teachers the necessity of giving their pupils more oral instruction. And, in order that the teachers themselves might be somewhat competent to give such instruction, I have advised them to pursue a systematic course of reading, to become familiar with such books as Calkins' Object Lessons. Many teachers have acted according to this advice, and the result is that they are much more competent to teach primary pupils than they formerly were. We still need much better teachers than we have for our primary schools. Certificates to teach should not be granted to persons under eighteen years of age, and not to any one on an average percentage of less than seventy per cent.

EXTRACTS

FROM

REPORTS OF CITY SUPERINTENDENTS.

[In preparing these extracts for printing, there are occasional changes of words to improve the connection of sentences, also abbreviations or condensations of statements.]

SAN FRANCISCO.

JAMES DENMAN.......................................Superintendent.

The general statistical tables for the whole State, will give the statistical exhibits for San Francisco.

Teachers' Salaries.—In adopting the present schedule of salaries, the Board has indorsed the following important principles: First—That teachers with high grade certificates should receive higher salaries. Second—That long service in the cause of education should be recognized by better compensation; and, Third—That the higher grades of the department should be filled by competent teachers, who have had at least two years' experience.

SCHEDULE OF TEACHERS' SALARIES, ADOPTED AUGUST 13, 1874.

High Schools.

	Per month.	Per annum.
Principals	$250 00	$3,000 00
Special Teachers of Latin and Greek	175 00	2,100 00
Special Teachers of French and German	175 00	2,100 00
Special Teachers of Natural Sciences	200 00	2,400 00
Assistants in Boys' High School	175 00	2,100 00
Teachers of Senior and Middle Classes, Girls' High School	175 00	2,100 00
Teachers of Junior Classes, Girls' High School	135 00	1,620 00

Grammar Schools.

	Per month.	Per annum.
Principal of Lincoln Grammar School	$225 00	$2,700 00
Vice-Principals of Lincoln Grammar School	150 00	1,800 00
Principals of South Cosmopolitan, Denman, Rincon, Hayes Valley and Valencia Street Grammar Schools	200 00	2,400 00
Vice-Principals of said Schools	145 00	1,740 00
Principals of the North Cosmopolitan, Broadway, Union, Washington, Spring Valley, and Eighth Street Grammar Schools	185 00	2,200 00
Vice-Principals of said Schools	135 00	1,620 00
Head Assistants	100 00	1,200 00
Holders of First Grade Certificates, teaching Third and Fourth Grade Classes exclusively for boys	75 00	900 00
Holders of First Grade Certificates, teaching other classes, Third and Fourth Grades	72 50	870 00
Holders of Second Grade Certificates, teaching Third and Fourth Grade Classes, exclusively for boys	72 50	870 00
Holders of Second Grade Certificates, teaching other Classes, Third and Fourth Grades	70 00	840 00
Holders of First Grade Certificates, teaching Second Grade Classes, of boys exclusively	85 00	1,020 00
Holders of First Grade Certificates, teaching other classes, Second Grades	77 50	930 00
Holders of First Grade Certificates, teaching First Grade Classes, of boys exclusively	92 50	1,110 00
Holders of First Grade Certificates, teaching other classes, First Grades	85 00	1,020 00

NOTE.—Teachers of First or Second Grade Classes must be holders of First Grade Certificates, and teachers of Third or Fourth Grade Classes must be holders of the First or Second Grade Certificates. No teachers shall be employed in Grammar Classes, except those who have had two years experience in teaching.

Primary Schools.

	Per month.	Per annum.
Principals having ten classes or more	$150 00	$1,800 00
Principals having five classes and less than ten, who teach classes	150 00	1,800 00
Principals having four classes or less	100 00	1,200 00

Assistants.

	Per month.	Per annum.
Holders of Third Grade Certificates, who have had no experience in teaching. First year	$50 00	$600 00
Holders of Third Grade Certificates, who have had no experience in teaching. Second year	55 00	660 00
Holders of Third Grade Certificates, who have had no experience in teaching. Third year	60 00	720 00
Holders of Second Grade Certificates, who have had no experience in teaching. First year	55 00	660 00
Holders of Second Grade Certificates, who have had no experience in teaching. Second year	60 00	720 00
Holders of Second Grade Certificates, who have had no experience in teaching. Third year	65 00	780 00
Holders of First Grade Certificates, who have had no experience in teaching. First year	60 00	720 00
Holders of First Grade Certificates, who have had no experience in teaching. Second year	65 00	780 00
Holders of First Grade Certificates, who have had no experience in teaching. Third year	70 00	840 00

NOTE.—Teachers who have taught two years in any Public School in the United States, will be credited with that experience on entering this Department, and will enter on the advanced salary according to grade of Certificate. This schedule for the salaries of primary assistants shall apply to those teachers only whose salaries will thereby be increased, and to teachers hereafter to be elected; but it shall not apply so as to occasion the reduction of the salaries of any teachers heretofore elected.

General Rule of Increase of Salaries on account of Experience in Teaching in the Public Schools of San Francisco.

Assistants, both in Primary and Grammar Schools, shall be entitled to the following increase of salaries over and above the preceding schedule of salaries:

	Per month.	Per annum.
Increase at the end of four years	$5 00	$60 00
Increase at the end of seven years	7 50	90 00
Increase at the end of ten years	10 00	120 00

This shall apply to all assistants now elected, according to the time of their service.

Special Schools.

	Per month.	Per annum.
Principal of Model School	$175 00	$2,100 00
Principal of Colored School	100 00	1,200 00
Assistants Colored School	75 00	900 00
Principal of Evening School	75 00	....
Assistants, Evening School	50 00	....

Unclassified Schools.

	Per month.	Per annum.
Principal of South San Francisco School	$150 00	$1,800 00
Principal of Potrero School	125 00	1,500 00
Principal of Fairmount School	100 00	1,200 00
Principal of Pine Street School	100 00	1,200 00
Principal of Ocean House School	100 00	1,200 00
Principal of Point Lobos School	100 00	1,200 00
Principal of West End School	100 00	1,200 00
Principal of Laguna Honda School	100 00	1,200 00

Special Teachers of Languages.

	Per month.	Per annum.
Holders of First Grade Certificates in both German and French, teaching in Grammar Schools	$125 00	$1,500 00
Holders of First Grade Certificates in either French or German, teaching in Grammar Schools	100 00	1,200 00
Holders of First Grade Certificates in both German and French, teaching in Primary Schools	100 00	1,200 00
Holders of First Grade Certificates in either French or German, teaching in Primary Schools	80 00	960 00
Holders of Second Grade Certificates, French or German	75 00	900 00
Holders of Third Grade Certificates, French or German	70 00	840 00
Special male assistant, South Cosmopolitan Primary	100 00	1,200 00

Teachers of Music, Drawing, and Phonography.

	Per month.	Per annum.
Principal Teacher of Music	$200 00	$2,400 00
Assistant Teachers of Music in Grammar Grades	150 00	1,800 00
Assistant Teachers of Music in Primary Grades	125 00	1,500 00
Principal Teacher of Drawing	200 00	2,400 00
Assistant Teachers of Drawing	150 00	1,800 00
Teacher of Phonography	175 00	2,100 00

Cost of Instruction.—The average number belonging was twenty thousand seven hundred and fifty, and the current expenses were six hundred and seventeen thousand six hundred and seventy-seven dollars and five cents. This amount, divided by the average number belonging, gives twenty-nine dollars and seventy-six cents. This is an increase of seven dollars and fifty cents over the tuition per capita of eighteen hundred and seventy. The whole number of pupils who have been enrolled for a longer or shorter period, is twenty-nine thousand four hundred

and forty-nine. This number has been educated at an entire expense (not including the appropriations for building) of six hundred and eighty-six thousand four hundred and seventy-nine dollars and eighty-nine cents, which is an average of twenty-three dollars and thirty-one cents. This is an increase of five dollars and seventy-seven cents per pupil on the amount expended in eighteen hundred and seventy. This increase in the cost of tuition is owing mainly to the yearly increase of teachers' salaries, the large amount expended for furniture and repairs, and to the reduced number of pupils taught in each class in many of our Grammar and Primary Schools. The annual cost of educating a child in the Primary Schools is about nineteen dollars and twenty cents, while in the High School the average cost is about seventy-nine dollars and eighty cents a year.

Evening Schools.—The attendance at the Evening Schools during the year has been gratifying. The young men have generally shown a marked improvement in their studies. Quiet, order, and discipline have been secured, especially in the Lincoln building, without much effort, or resort to force. During nine months of the year there were five schools in operation, taught by twenty-eight teachers. The whole number enrolled was two thousand one hundred and seventy-three; the average monthly enrollment was one thousand and eleven; the average daily attendance was 602.5; the highest number attending any month was one thousand one hundred and twenty-six. Generally the teachers have devoted themselves to their difficult work with commendable zeal, and have shown encouraging results. Quite a large number of young men who are foreigners and were unable to speak our language on entering the school, have made remarkable progress in acquiring a sufficient knowledge of English to enable them to read and transact business with facility. The class in mechanical and industrial drawing has done excellent work during the year. The instruction imparted is of that practical character which will fit the young men of our city for the practical duties of the shop, the designing or the drafting room. I cannot commend this system of instruction too strongly to the Board of Education and the citizens of San Francisco. It is the only place in the city where young men can, without cost, obtain practical instruction in the science of the most important trades, by means of which the great mass of people in all large cities acquire their daily support. The young men in book-keeping have made commendable progress. While this class has generally been well attended, the large number of pupils receiving instruction at the Commercial Colleges of San Francisco shows that our school system does not afford the youth of the city that practical business education which is demanded in every great commercial emporium. I therefore earnestly recommend that greater facilities be afforded to a large class of youth who are engaged in workshops and stores during the day, to acquire a thorough knowledge, which will fit them to perform the business duties of life. Instruction should not only be given in book-keeping, but commercial arithmetic and the legal and business forms of trade, should be thoroughly taught in our schools. I regret to report that the girls of the city have not generally availed themselves of the advantages afforded by the Evening Schools. While there are nineteen classes for boys, with an average daily attendance of 534.5, there was only one class for girls, with an average attendance of sixty-eight. This shows that the girls of San Francisco do not take the same

interest in the instruction given in these schools that they do in other cities. In October, eighteen hundred and sixty-eight, the attendance at the Evening Schools of New York was twelve thousand five hundred and sixty-one, of whom eight thousand five hundred and sixty-one were males, and four thousand females. In other Eastern cities the proportion of the sexes is nearly the same. Our Evening Schools have already accomplished great good in providing the means of educating a large class of youth who in early life have been deprived of the facilities of elementary instruction and culture. They should therefore continue to receive the fostering care and support of the Board of Education.

High Schools.—The whole number of pupils enrolled in the Girls' and Boys' High Schools was six hundred and fifty-six; the average daily attendance was five hundred and nineteen; and the percentage of attendance was ninety-six. The number of pupils attending the High Schools is two per cent of all the children attending the public schools, or about one in fifty, and allowing two hundred thousand for the population of the city, there is only one pupil in the High Schools to every three hundred and five inhabitants. The average number of pupils enrolled in the High Schools is 11.2 per cent of the average number of children enrolled in the Grammar Department. The number of pupils admitted to the High Schools from the first grades of the Grammar Schools at the June examination, was two hundred and forty-eight, from other schools was twenty, making two hundred and sixty-eight in all, which is 48.8 per cent of all the first grade pupils examined for promotion. While the number of pupils in our High Schools will compare favorably with the attendance in any other city of the country, and is greater in proportion to the population than in many of the Eastern States, these statistics show that but a small portion of our juvenile population can ever avail itself of the culture and thorough course of instruction imparted in these higher institutions of learning.

Boys' High School.—Notwithstanding the great disadvantages and inconveniences under which this school has labored, arising from the want of suitable accommodations, it has passed another year of usefulness and prosperity. The whole number enrolled during the year was two hundred and forty; a gain of one hundred and nine, or eighty-three per cent. The average daily attendance was one hundred and eighty; a gain of eighty-four, or eighty-seven per cent. The whole number of teachers employed in this school was seven. The average daily attendance to each teacher was twenty-five and five sevenths. The whole number promoted from the Grammar Schools at the June examination was eighty-one; received from other sources, ten; making a total of ninety-one admitted for the next school year. Since a large number of pupils entering this school wish to fit themselves for the University as early as possible, I desire to recommend a change in the course of study, so that boys may be prepared in one year for admission to the Freshman class of the University. The only studies required for admission to the Scientific and Literary Department of the University, in addition to the Grammar School course, are, algebra to quadratics, and the first four books in geometry. Any boy with ordinary capacity can prepare himself in these branches in one year, and in addition, review arithmetic, grammar, history, and geography. If these changes were adopted by the Board of Education, much of the opposition of the public, and the discontent of the pupils, in regard to the curriculum of studies in this school, would cease. It would meet the wants of a large number of youth who desire to attend the University, and who feel that their time

is too precious to spend three years in preparing themselves in studies which they will have to review after entering that institution.

Girls' High and Normal School.—The Girls High and Normal School still sustains a high position in the public estimation. Since most of the graduates of this school are candidates for positions as teachers in our public schools, it has become one of the most important educational institutions under the control of the Board of Education. The whole number enrolled during the year was four hundred and sixteen, a gain of one hundred and seven, or thirty-four per cent; the average daily attendance was three hundred and thirty-nine, a gain of thirty-seven per cent; the whole number of teachers employed was fourteen; average daily attendance to each teacher was twenty-four and three fourteenths. The number of graduates this year was fifty-four; of these, thirty-five have applied for certificates to teach; six have received first grade, five second grade, and twelve third grade certificates; and twelve failed to pass. The number promoted to this school from the first grades of Grammar Schools at the June examination, was one hundred and sixty-seven, and ten from other sources. The failures and low percentages received by most of the graduates of the Girls' High and Normal School at the competitive examinations, for teachers' certificates, show conclusively that the present system of instruction has failed to accomplish the great object of this institution. Upon investigation I have ascertained that of the one hundred and seventy-two young ladies now in the junior class, one hundred and fifty-two desire to prepare themselves for teachers. The Board of Education should, therefore, immediately provide for the Normal instruction of this large number of candidates for the teacher's profession. The records also show, that a large number of instructors now in the Department have been members of the High School; it is, therefore, a question of the highest importance to the cause of education how this institution shall be conducted, so as to send forth each year its large number of teachers better prepared to discharge their responsible and difficult duties in educating the youthful mind and heart, for the lessons here imparted are disseminated in every part of the city, and should exert a powerful influence in promoting the usefulness and prosperity of our Public Schools. Since the city is fully empowered by law to establish a Normal School, the Board of Education has provided, in the new course of instruction, that "the Normal class shall be composed of such girls as may desire to fit themselves for teaching. It shall be open to pupils of any year's course, and shall receive half an hour's instruction daily, in the science of education and the art of teaching, in the proper methods of imparting instruction in the several grades of the Primary and Grammar Schools, and in the practical management and discipline of schools." Nothing more remains to be done to organize this important department of the High School but the employment of competent and skillful educators, well versed in all the modern methods of Normal School instruction. I cannot, therefore, too strongly urge the Board to make ample provisions for securing, as soon as possible, the ablest instructors of the country to take charge of the Normal classes; although the city will have to offer liberal salaries to secure such talent from our own State or from the East, yet I think that the public funds cannot be appropriated to a better purpose.

Model School.—This school is doing good work under the supervision of Mrs. DuBois, in preparing young ladies for the daily drill and practical work of the school room. But as a practice department of the Girls'

High and Normal School it can never develop its full usefulness, until the Normal classes of the High School are properly arranged and instructed. The drill of the one should supplement the instruction of the other, and both should work in harmony together. Unless this is the case, very little good can be accomplished. The Principal of the Normal School should arrange and direct the daily routine of the Training School, so that each pupil can have a systematic drill in the class room in the theories and lessons which she will be called upon to impart to others. The number of graduates of different State Normal Schools teaching in the Department, is one hundred and six. They are generally doing excellent work, and take a high standing in our corps of teachers. I trust that the Board of Education will give such acknowledgment and support to those teachers who have received a professional education, that most of our schools will soon be filled by Normal graduates, thoroughly drilled in all the modern methods of instruction.

Grammar Schools.—The whole number of pupils enrolled in these classes during the past year was six thousand five hundred and forty-six; the average number belonging was four thousand seven hundred and ninety; and the average daily attendance was 4,565.2. The whole number of teachers employed was one hundred and fifty-eight, viz: twelve male principals; one female principal; five male principals of ungraded schools; four female principals of ungraded schools; eleven male vice-principals and four female vice-principals; eleven female head-assistants; four music teachers; four drawing teachers; one teacher of phonography, and ninety-one assistants. The average number of pupils to each teacher was thirty and one third, and the average daily attendance was twenty-nine. The whole number examined in all the Grammar Grades was four thousand three hundred and fifteen, of which three thousand and six were promoted, and one thousand three hundred and nine failed. Two hundred and eighty-nine pupils have completed the work of the Grammar Schools and have received certificates of promotion; of this number, two hundred and forty-eight, or eighty-five and eight tenths per cent have been admitted into the Boys' and Girls' High Schools.

Since it cannot be claimed that the course of instruction for the grammar grades during the last year was too difficult, the large percentage of failures shows either a want of thorough and systematic instruction, or that the pupils were not properly prepared for promotion, from the lower grades. After making due allowance for the large number of promotions last year on account of the very easy examination, which filled many of the classes with poorly prepared pupils, it must be confessed, that the report of the annual examinations of this year has not been very satisfactory. It shows a want of thorough drill in principles, and a too slavish adherence to the text-books and the prescribed course of study. In some of the schools it gave painful evidence of too much cramming the last quarter, to make up for the time frittered away during the first part of the year. But these remarks do not apply to all of the instructors of the public schools; many of our teachers have labored earnestly and intelligently in educating their pupils, and their faithful and efficient labors have produced the most favorable results.

Primary Schools.—The whole number of primary schools taught during the year was twenty-four; the whole number of pupils enrolled was 20,074; the average number belonging was 14,688.6, and the average daily attendance was 13,694.8. The whole number of teachers employed was three hundred and thirty-five—five males and three hundred and

thirty females; the whole number of classes was two hundred and ninety-eight; the average number of pupils to each class was $49\frac{2}{5}$; the average number of pupils to each teacher was 43.8, and the average daily attendance to each teacher was $40\frac{4}{5}$. The whole number promoted from the fifth grade to the grammar department was one thousand one hundred and eighty-six. The whole number examined was twelve thousand and three, of which eight thousand one hundred and twenty-four were promoted, and three thousand eight hundred and seventy-nine failed. Since the statistics of the school department show that a large majority of our juvenile population are dependent upon these elementary classes for their instruction, I have devoted the most of my time and attention to the primary schools. It affords me great pleasure to report that our primary teachers are generally doing excellent work. While it is true that some of the classes have not been so well taught as they should have been, with few exceptions the instruction and discipline will compare favorably with the training of any other schools in the country. Most of the lady principals have discharged with great ability their difficult and trying duties in governing and managing the large number of pupils and teachers under their charge. Great progress has been made in teaching language, especially in the fifth and sixth grades. Correcting false syntax and sentence-making have received considerable attention. The compositions in some of the classes of the sixth and seventh grades show a better knowledge of the use of the English language than many of the pupils of the grammar grades possess. Since the course of study last year left the subject of oral instruction optional with the principals of primary schools, but little attention was given in most of the schools to that important department of elementary instruction. This is to be regretted, since most of the instruction during the first years of every child's education should be by familiar conversation. "It is by familiar conversation in regard to actual objects and feelings that the parent calls forth the first glimmering intelligence of childhood. So it is by conversation, or to call it by its technical name—oral instruction—that the teacher should continue the instruction first begun." According to the new course of study, ample provision has been made for a well arranged course of oral instruction, which cannot fail to prove instructive and useful.

Colored Schools.—Two colored schools have been sustained during the year, with a total enrollment of eighty-one pupils. There were three teachers employed, with a daily average attendance of forty-three scholars, or thirteen and one third to each instructor. The average daily attendance in the Fifth-street School was eight, costing the city one hundred and twenty dollars a year for the tuition of each pupil. In the Vallejo-street School the daily average attendance was thirty-five, costing the city sixty-five and one seventh dollars a year for the instruction of each pupil. I regret to report that the progress of these schools has not been satisfactory. This is not owing so much to the inefficiency of the teachers as to the general dissatisfaction of the colored people with the maintenance of separate schools for their children. They take but little interest in sustaining their present schools, and will be satisfied with nothing less than the admission of their children into the other public schools of this city.

Corporal Punishment.—I regret to report that too many of our principal and assistant teachers have abused their power to inflict corporal punishment upon the little children under their charge. During the year, eighteen thousand three hundred and sixty-seven cases of cor-

poral punishment have been reported, which is probably far below the real number, since many of the teachers admit that they record only the more severe cases. While many of our teachers have secured good order in their classes, without frequent resort to physical force, it cannot be denied that the above figures show that undue severity has been exercised in the government of dependent youth, which should command the early consideration of the Board of Education. Since the repeal of the rule of the Board limiting the right to inflict corporal punishment to the principals of the schools, many of the young and inexperienced assistants have been in the habit of whipping little boys and girls for the most trivial offenses. In one school which reported one thousand seven hundred and eighty-seven cases, I ascertained upon investigation that the reason given for punishing the little children, ranging from six to ten years of age, was because they could not recite their lessons, or were unable to write their problems correctly on the blackboard. In order to protect the helpless and dependent children in our public schools from passionate and inexperienced teachers, I respectfully recommend the Board of Education to limit the authority to inflict corporal punishment to the principals of the schools. While I am in favor of the great reform which is abolishing the frequent use of the rod for every offense committed in the school, I am not unmindful of the fact, that there is a large class of children as well as men in every community who cannot be permanently controlled except by compulsion and force. The pupils of our schools are not all seraphs; collected as they are from every grade of our cosmopolitan society, they represent all the passions which humanity is heir to. It is, therefore, impossible to govern them all by the power of moral suasion which the most gifted and kind-hearted teacher may possess. Force must at times be used to subdue the self-willed, and the naturally vicious and disobedient pupils, or else they must be expelled from school, and thrown upon the community to learn the lessons of the street, lessons at war with the vital interests of the people. It would be transferring them to a school in which they would make rapid progress in disobedience to parents, prevarication, obscenity, profanity, intemperance, petty thieving, robbery, and murder. This alternative of expulsion from school is a dangerous expedient for society, and the best interests of wayward youth. If this policy were adopted, there would be found a large number of boys in our schools who, from their own inclinations, or from the vicious influence of others, would gladly embrace the first opportunity of throwing off the cares and restraints of the school-room, which their disobedience and misconduct would afford them. It would practically place it in the power of each refractory pupil to leave school whenever his whim or caprice might lead him to disobedience. Under such a system it would take but a short time to empty our school-rooms of the stubborn and vicious, who most require the wholesome influence of restraining laws and proper discipline. It would soon populate our streets with the idle and the vicious, and crowd our prisons and Industrial School with juvenile offenders. This is not an imaginary or wild statement of the evils of expulsion. There is a large number of children in our city who would regard it a boon, and not a penalty, to have the doors thus opened to them to lead lives of crime and idleness.

Our police records and crowded Industrial School show that we have already too large a number of this class of juvenile offenders for the present and future welfare and safety of the city.

Special Schools.—It may be asked what course shall be adopted to reclaim the rebellious and wayward youth of our schools, if they will not yield to moral suasion or proper force. It is a serious question to answer, and one which is exciting the interest and attention of the statesman and the philanthropist everywhere. According to a resolution of the Board of Education, I have corresponded with school officers and educational gentlemen of Eastern cities, in regard to the best system of discipline and government for vicious and incorrigible pupils. I find but few who are satisfied with the means which have been adopted for the reformation of juvenile offenders. The most practical plan which I can suggest from my inquiries and investigations, is the establishment of one or two central classes in different parts of the city, at which all the most refractory and unmanageable pupils shall be compelled to attend until they are thoroughly reformed, and are willing to submit to the authority of the school without recourse to the rod. The most competent and successful teachers to manage and govern obstinate and refractory pupils should be selected to discipline and instruct these classes. They should be gentlemen of large experience, with feelings and instincts in harmony with child nature, and should possess a firmness of character and kindness of heart which would enforce respect and obedience without severity. With such instructors, I think great good would result to our public schools by establishing one or more classes for the training of our juvenile offenders. The truant officers should visit them daily to look after absentees. It would add but little to the expense of the School Department, and would relieve the different schools of some of the most turbulent and troublesome scholars, who are a constant annoyance to their classes, and who require too much of their teacher's time to keep them in subjection. In many of the Eastern cities incorrigible and truant scholars are sentenced to long terms of confinement in houses of correction and industrial schools, where, instead of reforming, they too frequently become confirmed and hardened offenders against the law and peace of society. Confinement in cells is not a proper means of reforming erring youth. A prison may be a fit place for hardened criminals, but should never be the home of susceptible youth except as a last resort. It is, therefore, with no ordinary feeling of earnestness that I would recommend the Board of Education to establish at once a school for the reformation of refractory boys. Its halls and yards should be furnished with all the modern improvements which can make the school pleasant and attractive, and with such able and philanthropic teachers as I have described, I predict for it a great sphere of usefulness to society and humanity in rescuing the wayward youth of our city from lives of disorder and of crime. In accordance with the recommendation of this report a school of two classes was opened in April, eighteen hundred and seventy-two, in the basement of the Baptist Church, on Washington street, near Stockton. On account of their imperfect organization and supervision these classes have since been abolished. If they were properly reorganized under the management of able teachers, I am still of the opinion that the experiment would prove a great success and a blessing to the city.

Co-education of the Sexes.—Notwithstanding all that has been said and written in favor of co-education of the sexes, and the restraining influence which girls in the school-room have over boys, parents have objections to placing refined and sensitive daughters in the same class with rude and disorderly boys, which the most refined theories of the optimist cannot overcome. The Board of Education of San Francisco

has recognized this fact, in the organization of our public schools, by establishing four schools in different parts of the city, for the separate education of the girls, and four for the exclusive instruction of boys. These schools have grown in the public estimation, and are now regarded with such favor by a large majority of the parents sending their children to our public schools, that any attempt to abolish our present system of separate instruction for boys and girls in the few schools which have been established, would seriously injure the popularity of our system of public instruction. It would array against our schools a large class of foreign and native-born population, who believe that the severe discipline of mind and body necessary to prepare boys for the stern and eventful duties of the business world, is not suitable for the education of weak and sensitive girls, who must occupy entirely different positions in life. Those who believe that the highest type of womanhood and manhood can only be developed by the co-education of the sexes, have the privilege of sending their children to our mixed schools for boys and girls, which the Boards have established in different parts of the city; I therefore deprecate any attempt to change the present organization of our mixed and separate schools, in which those with different opinions upon this important subject of education, can all be accommodated. The public discussion of the medical profession, in regard to causes which have produced our sickly race of young ladies in America, has aroused the serious apprehension of reflecting parents in regard to our system of education for the female sex. While I am not willing to attribute all the ills which our young ladies are "heir to" to the unnatural confinement and physical discipline of our schools, I am compelled to believe with Dr. Clarke, that the tendency of the present age to ignore sex in the education of boys and girls is condemned by the laws of physiology and experience. "The sustained regimen, regular recitation, erect posture, persistent exercise, and uninterrupted labor, that toughens a boy and makes a man of him, can only be partially applied to girls." * * * "Identical education of the two sexes is a crime before God and humanity, that physiology protests against, and that experience weeps over. Because the education of boys has met with tolerable success in developing them into men, there are those who would make girls grow into women by the same process. Because a gardener has nursed an acorn till it grew to be an oak, they would have him cradle a grape in the same soil and way and make it a vine. Identical education, or identical co-education of the sexes, defrauds one sex or the other, or perhaps both. It defies the maxim which physiology has fully justified, *mens sana in corpore sano.*" In addition to the physiological objection of the medical profession to the *identical* and *co-education* of the sexes, I also believe with the lamented Dr. Nott of Union College, that "a difference of sex, and of destination through the entire life, has, in the judgment of mankind, been thought to require a difference in the distinctive attributes to be called into exercise, and the peculiar type of character to be formed. Delicacy of sentiment, a feeling of dependence, and a shrinking from the public view, are attributes sought for in the one sex; in the other, decision of character, self-reliance, a feeling of personal independence, and willingness to meet opposition and encounter difficulties. It is not easy to see how appliances for the production of such opposite results can be furnished by the same agencies, at the same time, and in the same school-room. Nor is it easy to see how young, susceptible, and inexperienced individuals of different sexes can be daily brought into familiar intercourse, and

subjected to such common appliances, in the absence of parental supervision, without endangering alike their virtue and happiness. Whatever economy, convenience, and beneficial results may be expected from the co-education of youth of different sexes, there are, it must be admitted, great difficulties to be overcome, and great dangers to be guarded against, in carrying such a system into effect; and besides, whatever might be thus gained to manners by diminished rudeness in the one sex, would, it is to be feared, be more than counterbalanced by the loss of native modesty in the other."

New Course of Study.—The experience of the last few years has convinced most of our principal and assistant teachers that a change in the course of study has been demanded by the best interests of the public schools. In addition to our common branches of reading, writing, arithmetic, geography, and language, there are other studies which should not be entirely neglected in the education of the youth of our primary schools. While I fully admit the inestimable importance of these studies in our common schools, I claim that they should not be taught to the exclusion of the great truths of natural science which are everywhere unfolded to the youthful mind. With the view of introducing the study of a few of the great facts of the world around us in connection with the fundamental branches usually taught in elementary schools, our present course of study was adopted by the Board of Education. While oral instruction is now made an important feature in the education of the primary and grammar pupils, I have endeavored to arrange the new course so as to give due prominence to those practical branches which girls and boys must find useful in every sphere of life. First in importance, I think every one will admit, is reading; for by it pupils are enabled to study and acquire facts independently of their teachers. If properly taught, it is one of the most powerful instruments for the expansion and cultivation of the mind. Special attention is therefore given to this important subject. In addition to the elocutionary training of the voice in every grade of the Department, the teacher is also required to drill his pupils in every sentence and paragraph until its meaning is fully comprehended. No pupil can now pass through even the primary grades without becoming an intelligent and pleasant reader, if the provisions of the manual are carefully observed. The study of arithmetic, which is next in importance, has been carefully revised; more attention is now given to analysis of principles. Colburn's Intellectual Arithmetic has been introduced in all the grammar grades, which will be productive of good results in strengthening the reasoning powers of the pupils. The study of geography is now taught with less slavish adherence to the text-book. More attention has been given to oral lessons upon the local geography of the Pacific Coast, its climatic influences, and its vegetable and mineral productions. Most of the minute details of the important maps have been omitted, and the general geography of the world is given in topic lessons, upon the principal mountain and river systems, the plains and plateaus, the physical influence of climate upon the commerce and productions of different countries, the peculiar vegetable and mineral products of the different zones and altitudes, the important minerals of different countries, and their relation to the manufacturing and commercial interests of the inhabitants. Language is now taught, either as an oral exercise or regularly from the text-books, in every grade of the grammar and primary

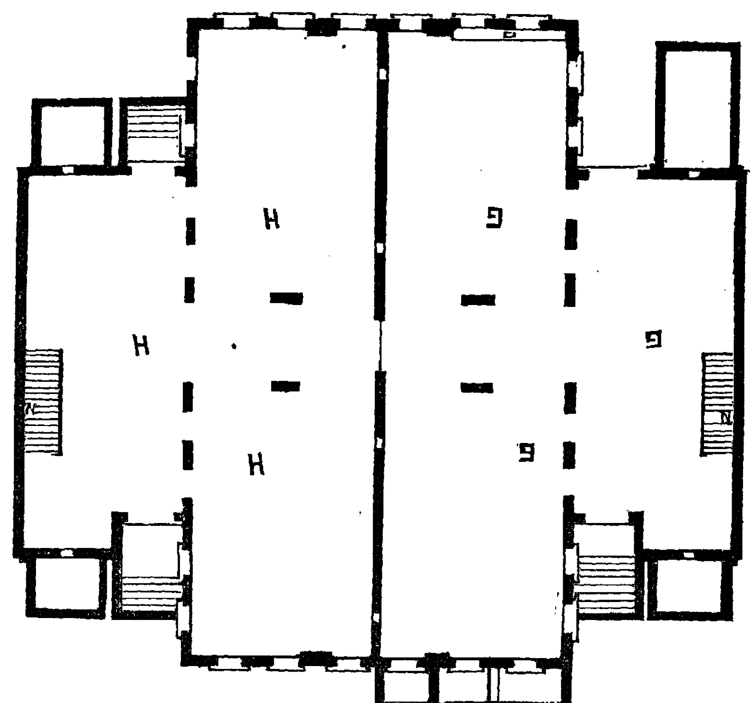
schools. In the eighth grade the child is taught to write sentences about familiar objects, by telling what they are or what they do. In the next higher grades the pupils are thoroughly drilled in sentence making, and how to correct the common blunders in conversation. They are also constantly practiced in the correct use of irregular verbs, pronouns, and adjectives. Letter-writing and composition is required in nearly all the grades. Parsing and analysis of sentences are now taught orally in the lower grades, with far greater ease and success than formerly, with the use of the text-book. In addition to the use of the word-book, spelling is now taught in connection with reading and other daily lessons, both orally and in writing. The low percentage which the more advanced pupils have received in spelling since the use of the text-book has been abolished in the first and second grades, has caused the Board of Education to restore the spelling book in these grades, which it is hoped will produce better results. The course of instruction in penmanship is now more thorough and systematic. All the pupils are required to prepare specimens in writing for the criticism of the principal, at least once in two weeks, which will secure greater efficiency in this most necessary part ef every child's education. Smith's system of freehand drawing has also been introduced, in the new course of study, in all the grades of the public schools. This important department of instruction is under the general supervision and control of a drawing master, assisted by three special assistants. Regular normal lessons are given by the special instructors every two weeks, for the purpose of drilling the teachers of the department in this new system of industrial drawing. Some of our teachers have taken great interest in instructing the pupils under their charge, in this essential branch of education, which has produced the most satisfactory results. Some of the specimens in drawing and designing, exhibited at the last annual examination, showed merit of the highest order, and reflected credit on both pupils and teachers. As soon as the merits of the new system are thoroughly understood by the teachers generally, I hope that much of the opposition to the introduction of this system of drawing will cease. The additional labor required of the teachers will be a thousand times compensated by the great benefits which it will confer upon the youth of our city. Drawing cultivates the hand that executes and the eye that sees; it awakens the perceptive faculties and stimulates the inventive genius of the pupils. It leads to a just appreciation of the mechanical arts, by which communities and individuals acquire wealth or obtain their daily bread. It is, therefore, a necessary preparation for every successful artisan. While I doubt the propriety of introducing the trades or professions into the curriculum of school studies, I think it is clear that mechanical drawing and designing have demands that no special form of manual industry can lay claim to.

Oral Instruction.—The course of study gives more than usual attention to the natural sciences. Since statistics show that nearly three fourths of the youth of our large cities are educated in primary schools, it is a question of the highest importance how far we can impart the most important facts of nature to those who are thus deprived in early youth of the means of acquiring a liberal culture. In St. Louis, Cincinnati, and other Eastern cities, the study of natural sciences has been successfully introduced in the lower grades of the public schools, to a far greater extent than has been attempted in San Francisco. I therefore predict that our new course of oral instruction will accomplish great

good in stimulating the youth of the city to observe and study the great facts of natural history and of physics, if our teachers will intelligently labor to interest their pupils in this important department of instruction. Great care has been taken to arrange this course, so as not to distract and dissipate the attention of the teacher and pupil from the regular lessons of the day. Two lessons of fifteen minutes during each week of the year, will afford the teacher ample time to complete the course. Those teachers who object to our course of "oral instruction," because it is too difficult, and requires too much of the pupil's time, are referred to the synoptical arrangement of the topics in oral instruction taken in the course of study in the district schools of St. Louis, published in the appendix to this report. While this course is much more difficult than our own, the time required to complete it is seven years, or one year less than in San Francisco.

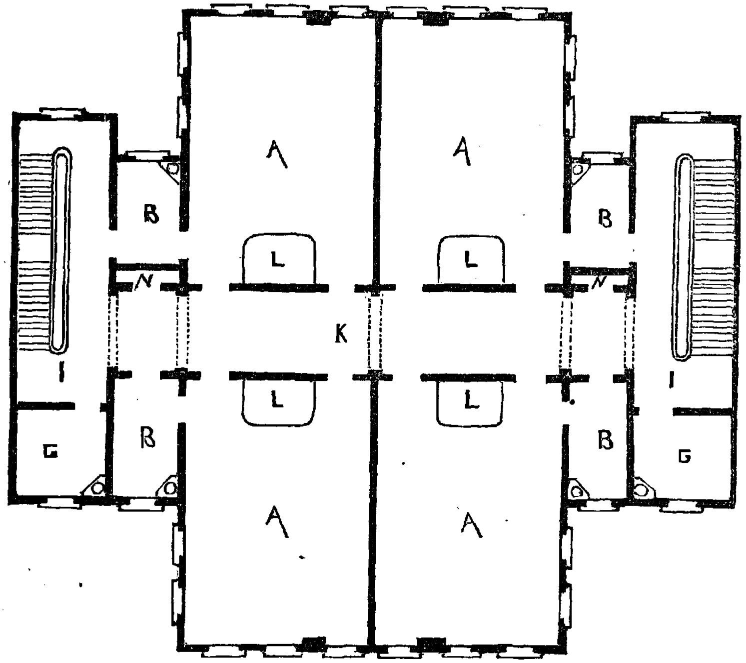
PUBLIC SCHOOL BUILDINGS.

THE GIRLS' HIGH SCHOOL.—This edifice is located on the southeast corner of Bush and Stockton streets. It is designed exclusively for girls, and will accommodate six hundred pupils. The building is fifty-six by ninety-two feet, built of wood, on a substantial brick foundation, having two wings, each ten feet six inches by thirty-nine feet six inches,



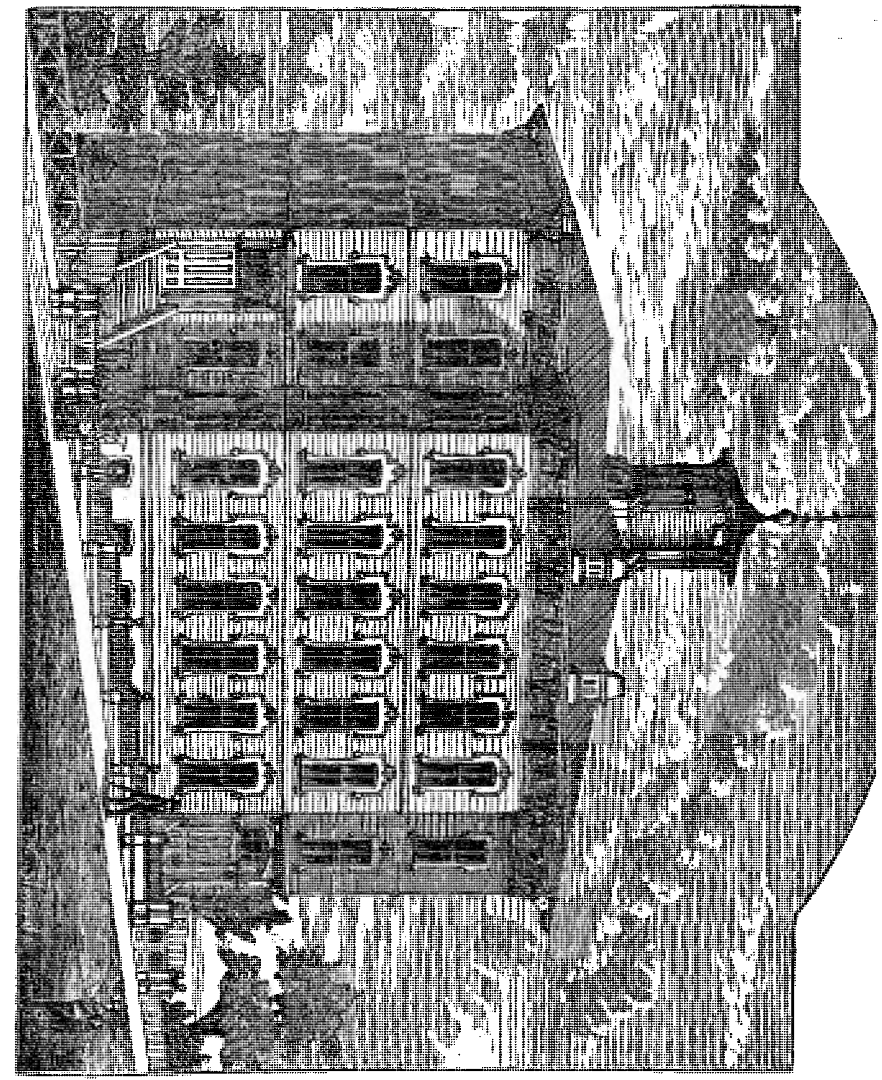
FIRST STORY.
E E, H H—Recitation Rooms.

containing the entrance halls, teachers' rooms, and the spacious stairways, which afford means for easy communication with the several apartments of the interior. The exterior of the structure is finished in a neat and substantial but not costly manner, with the leading characteristics of the Ionic order. The roof is surmounted by an appropriate cupola. The entire work is built in a very substantial manner, with unusually heavy timbers, securely united.

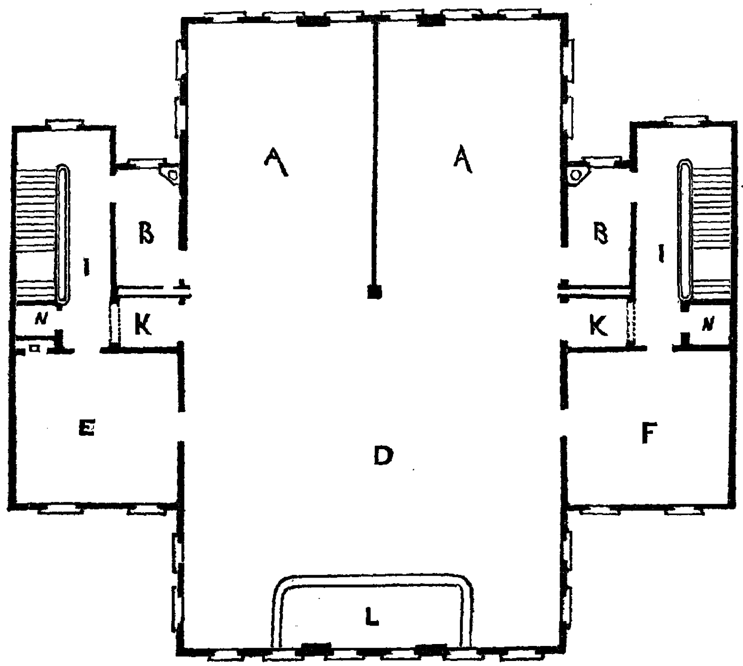


SECOND STORY.

AAAA—Recitation Rooms. *BBBB*—Clothes Rooms. *CC*—Teachers' Rooms.



GIRLS' HIGH SCHOOL, SAN FRANCISCO.



THIRD STORY.

AA—Recitation Rooms. D—Assembly Hall. E, F—Teachers' Rooms.

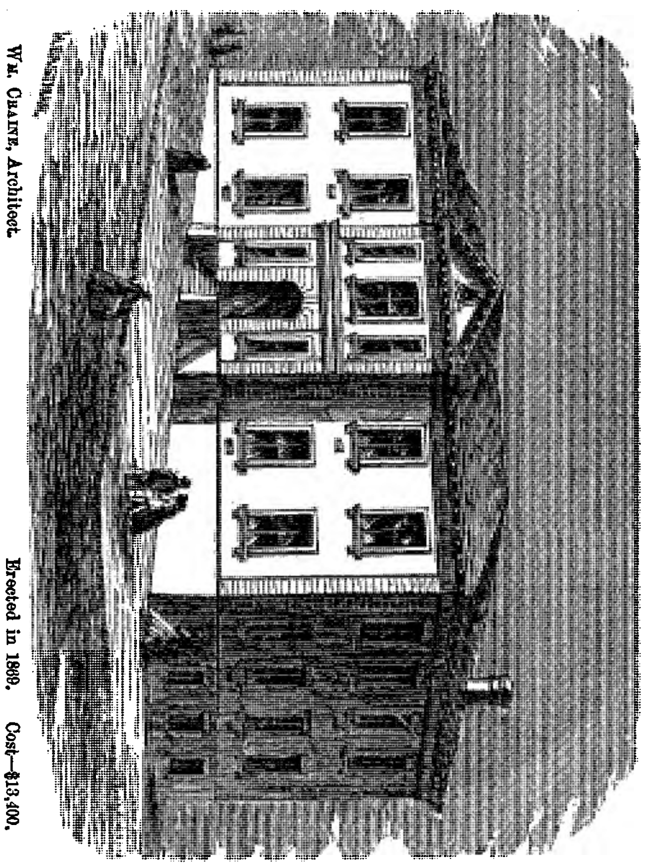
South San Francisco School.—This school is situated on the corner of L street and Fourteenth Avenue, in the rapidly improving locality known as South San Francisco, south of Mission Bay. The size of the lot used for the purpose is one hundred and fifty by one hundred feet, one hundred of which was donated by the citizens of that locality, and the balance was purchased by the Board of Education.

The building is a parallelogram, fifty-eight feet four inches by ninety-five feet three inches, two stories high, having projections in the center of the front and rear, each three feet by twenty-five feet six inches, in which the entrance doorways are placed. The structure is of frame, strong, heavy, and substantially built. It will give ample accommodations for four hundred and eighty scholars and their teachers. Two spacious stairways afford communication with the second story.

The first floor contains four class rooms, each twenty-eight by thirty-four feet, four wardrobe rooms, each six feet by twenty feet six inches, together with a hall eleven feet three inches wide, the story being fourteen feet six inches high. The second story is fifteen feet high, and contains two class rooms, each twenty-eight by thirty-four feet, two wardrobe rooms, each six feet by twenty feet six inches, together with

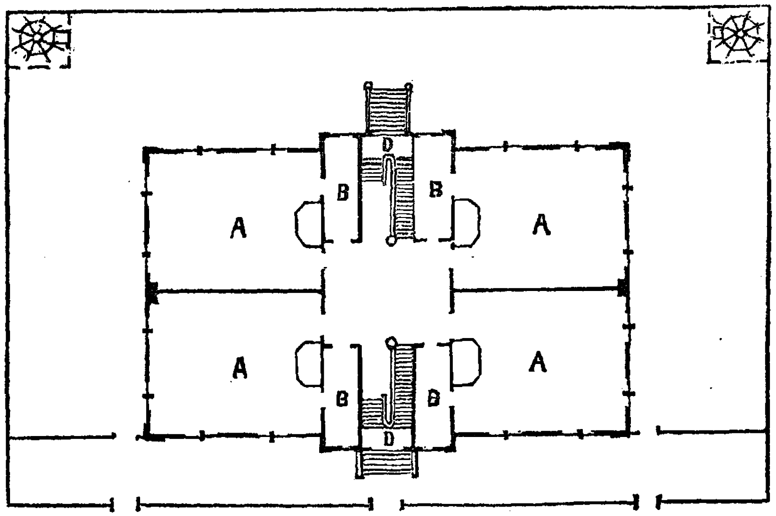
an assembly hall, fifty-six by fifty-six feet, for school examinations and exhibitions, which is a great convenience to citizens of that district.

The interior is well lighted and ventilated. Fresh air is introduced through metallic ventilating registers near the floor, and the impure air will escape through the ventilators near the ceiling into the roof, whence it will be discharged by means of louver windows in the front and rear gables. The exterior presents a plain but very pleasing appearance, and is finished with rustic surfaces, quoins, and with an expressive cornice around the building; the whole is painted of a light color, which gives the structure an air of cheerfulness.



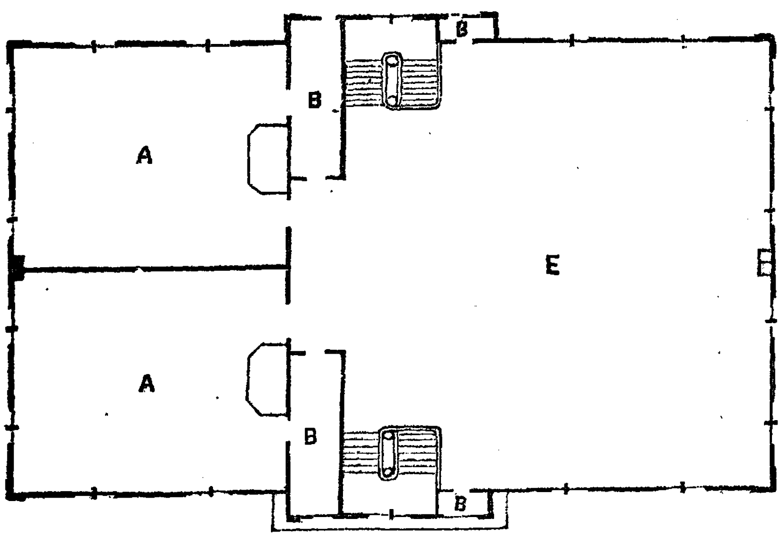
Wm. Craine, Architect. Erected in 1869. Cost—$13,400.

PUBLIC SCHOOL HOUSE, SOUTH SAN FRANCISCO.



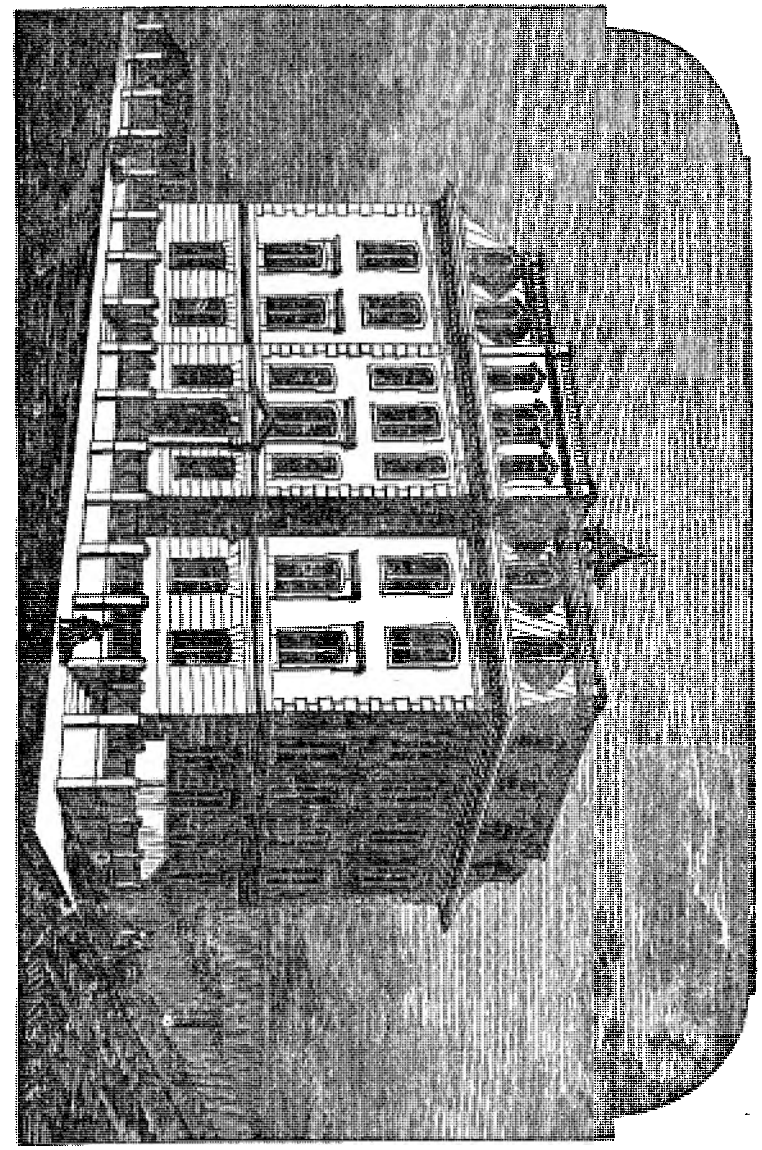
PLAN OF FIRST STORY, YARDS, ETC.

AAAA—Recitation Rooms. BBBB—Clothes Rooms. DD—Vestibules.

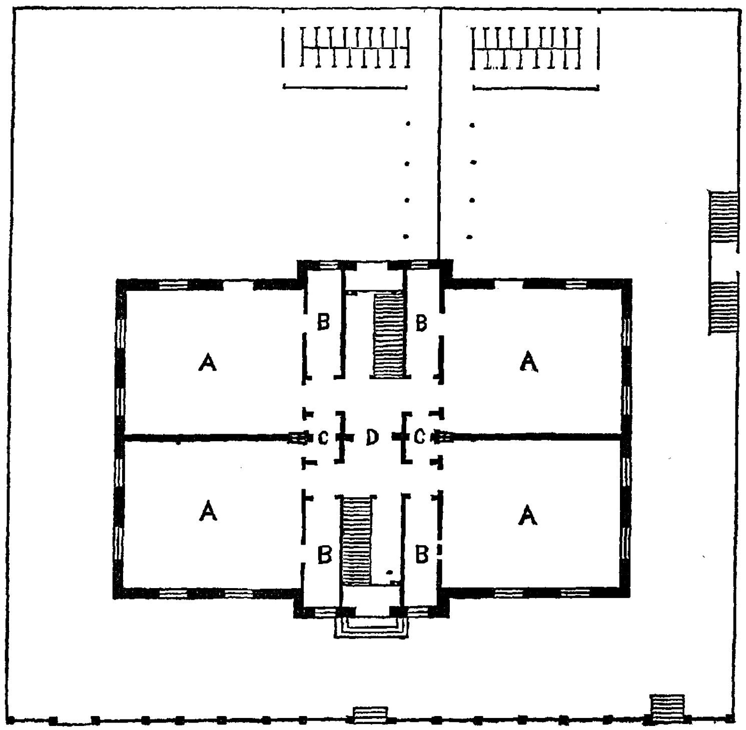


SECOND STORY.

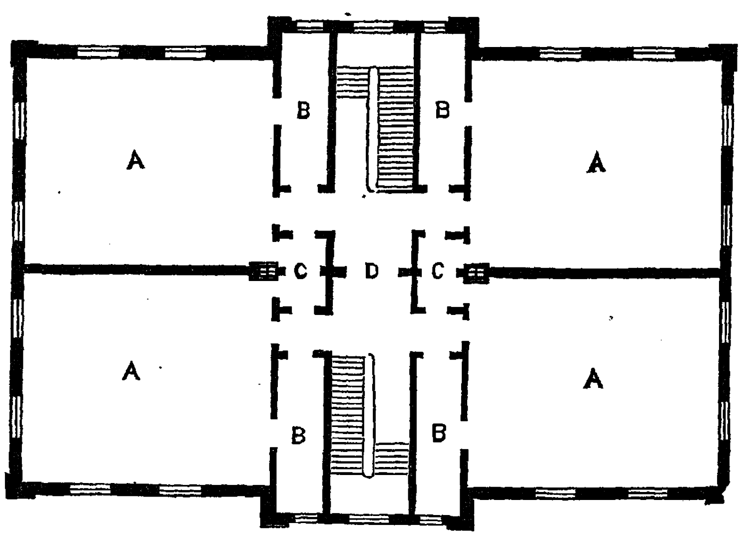
AA—Recitation Rooms. BBBB—Clothes Rooms. E—Assembly Hall.



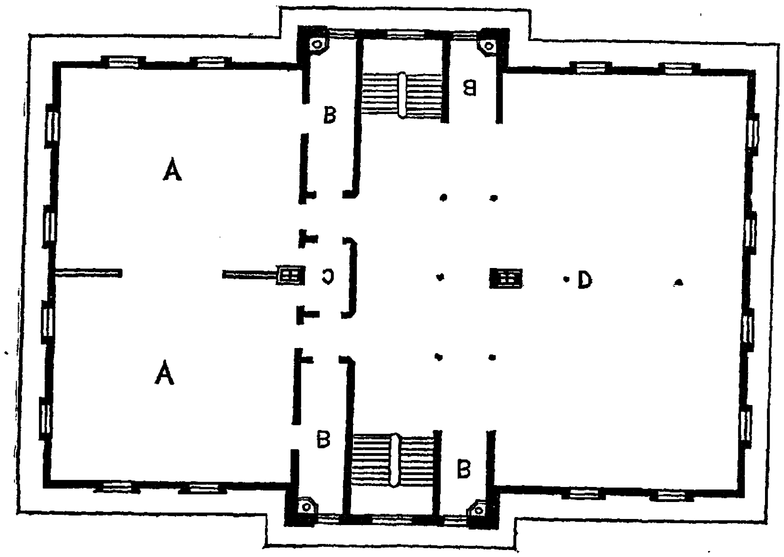
DENMAN GRAMMAR SCHOOL.



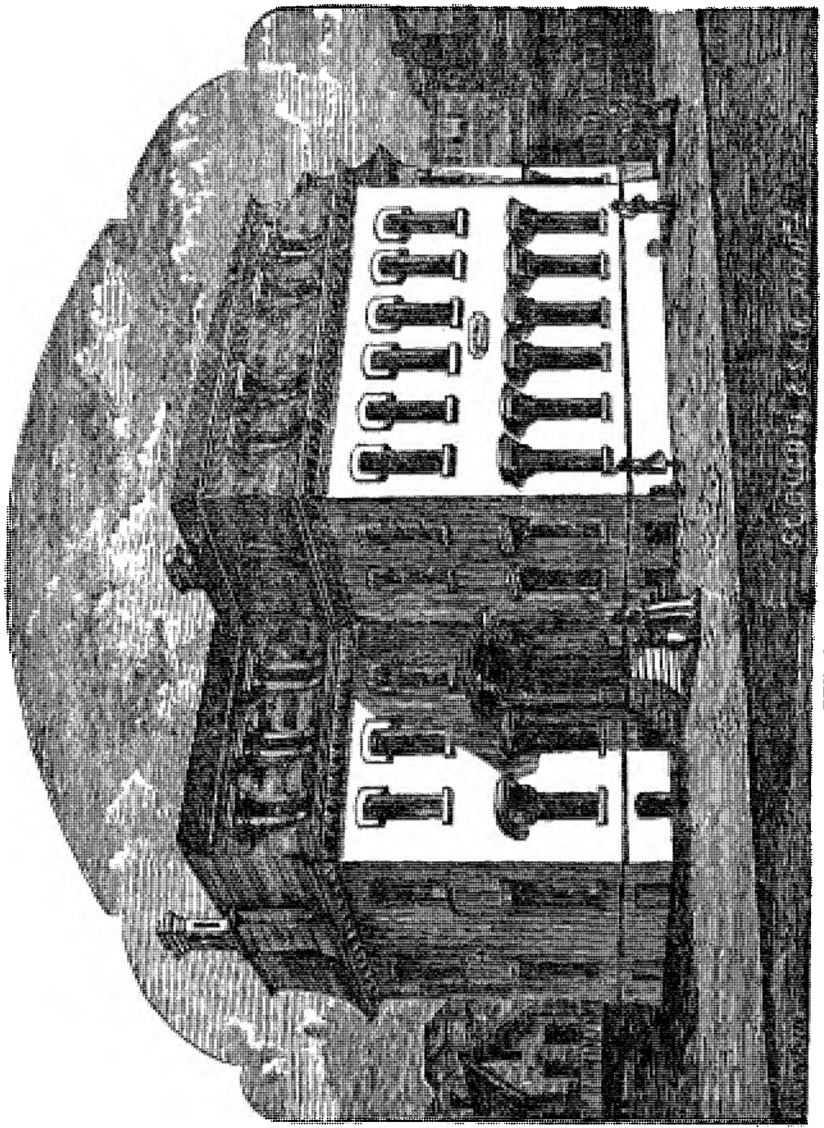
Plan of Basement.



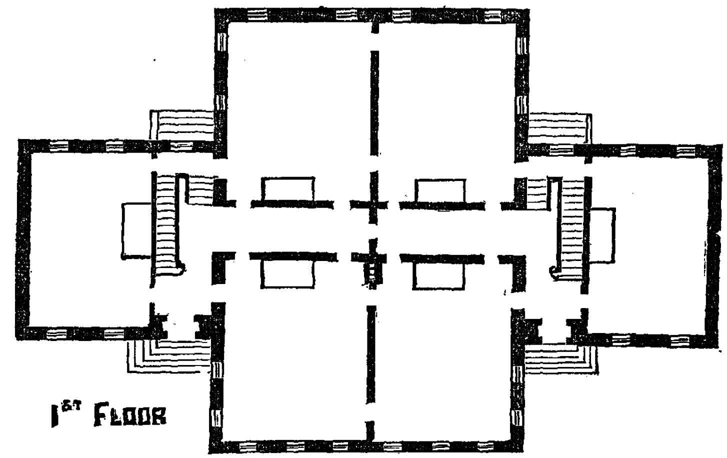
Plan of First and Second Floors.



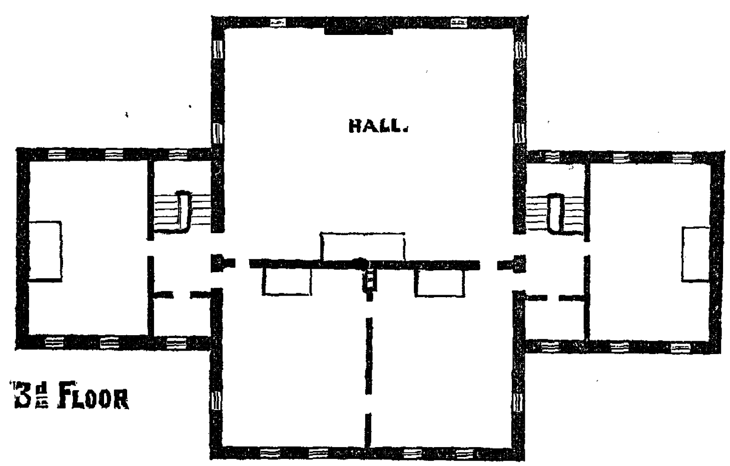
Plan of Attic.



TEHAMA PRIMARY SCHOOL.



Plan of First and Second Floors.



Plan of Third Floor.

SACRAMENTO.

ADD. C. HINKSON..................................Superintendent.

I have received only the following statistical information concerning the school department of this city:

Number of census children, June, eighteen hundred and seventy-five, 4,112.

Primary Schools.—Number of classes, 16; number of female teachers employed, 16; total number of pupils enrolled, 895; average number belonging, 817; average daily attendance, 693; maximum salary paid, $80; minimum salary paid, $50; total annual expense of maintaining schools, $17,098 80.

Intermediate, or Second Grade Schools.—Number of classes, 14; number of female teachers employed, 14; total number of pupils enrolled, 756; average number belonging, 714; average daily attendance, 603; maximum salary paid, $85; minimum salary paid, $55; total annual expense of maintaining schools, $14,961 45.

Grammar Schools.—Number of classes, 18; number of male teachers, 2; number of female teachers, 16; total number of pupils enrolled, 827; average number belonging, 753; average daily attendance, 687; maximum salary paid to male teachers, $175; minimum salary paid to male teachers, $100; maximum salary paid to female teachers, $100; minimum salary paid to female teachers, $80; total annual expense of maintaining schools, $18,885 72.

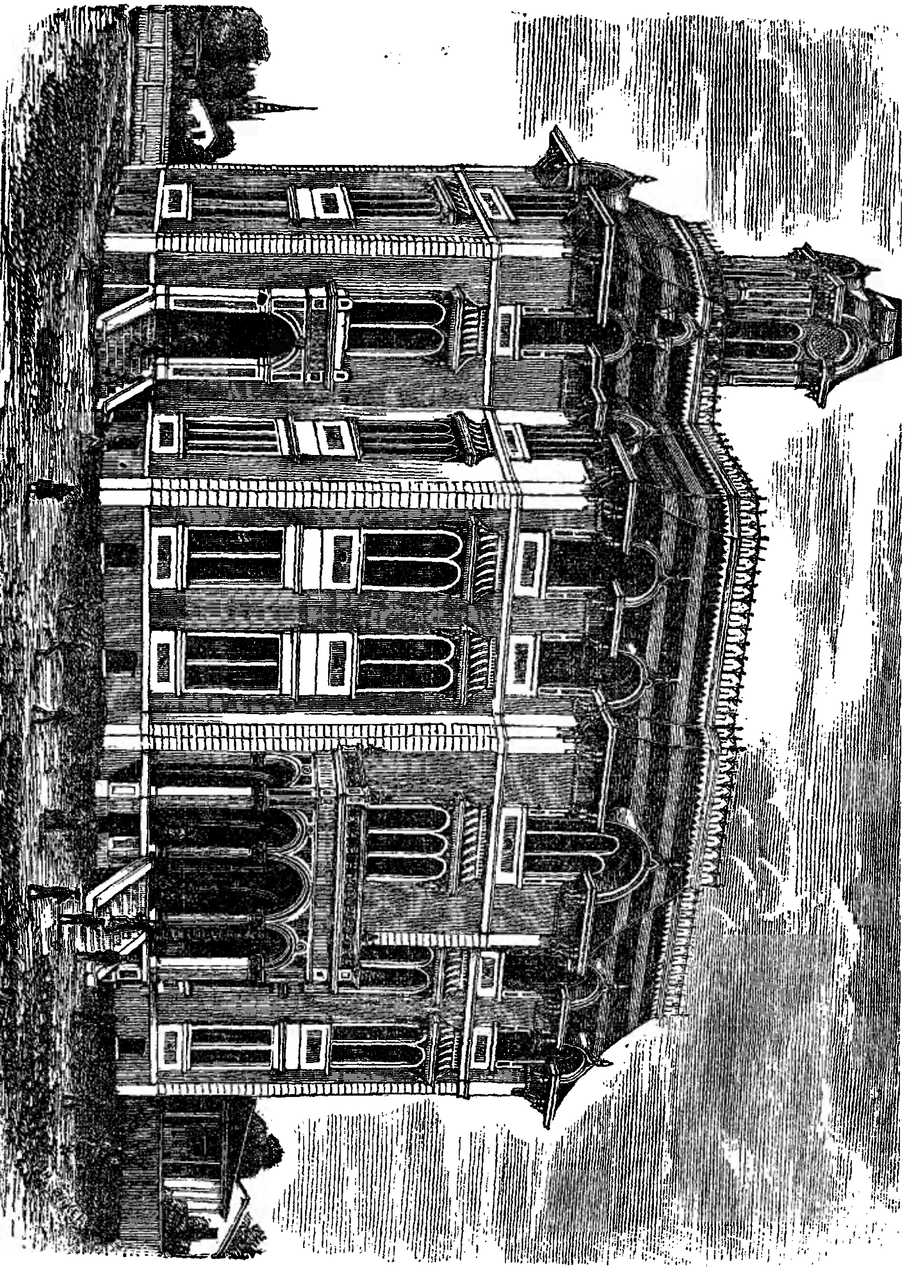
High School.—Number of classes, 4; number of male teachers, 2; number of female teachers, 2; total number of pupils enrolled, 105; average number belonging, 101; average daily attendance, 97; maximum salary paid to male teachers, $240; minimum salary paid to male teachers, $100; salary paid to female teachers, $100; total annual expense of maintaining schools, $6,000.

Evening School.—Number of classes, 2; number of male teachers, 2, one receiving $50, and the other $40; total number of pupils enrolled, 65; average number belonging, 60; average daily attendance, 47; total annual expense of maintaining school, $600.

Colored School.—One class taught by a female teacher, receiving $100; total number of pupils enrolled, 53; average number belonging, 48; average daily attendance, 38; total annual expense of maintaining school, $1,250.

Ungraded Schools.—Two classes, 2 female teachers, receiving each, $100; total number of pupils enrolled, 109; average number belonging, 97; average daily attendance, 85; total annual expense of maintaining schools, $2,300.

All the schools, except the evening school, are maintained ten months in the year; the evening school is maintained from six to seven months in the year; the teachers are paid by the month, and only for the time actually taught, and not by the year, as in San Francisco.



OAKLAND.

F. M. CAMPBELL.................................Superintendent.

Total number of census children, June, eighteen hundred and sevent five, 4,749.

Primary Schools.—Number of classes, 31, taught by 31 female teacher whose maximum salary is $100, and the minimum, $62 50; total numbe of pupils enrolled, 2,173; average number belonging, 1,962; averag daily attendance, 1,898.

Grammar Schools.—Number of classes, 23, taught by 5 male and 1 female teachers; total number of pupils enrolled, 1,124; average numbe belonging, 1,047; average daily attendance, 1,010; salary paid to mal teachers, $150; maximum salary paid to female teachers, $90; minimur salary paid to female teachers, $70.

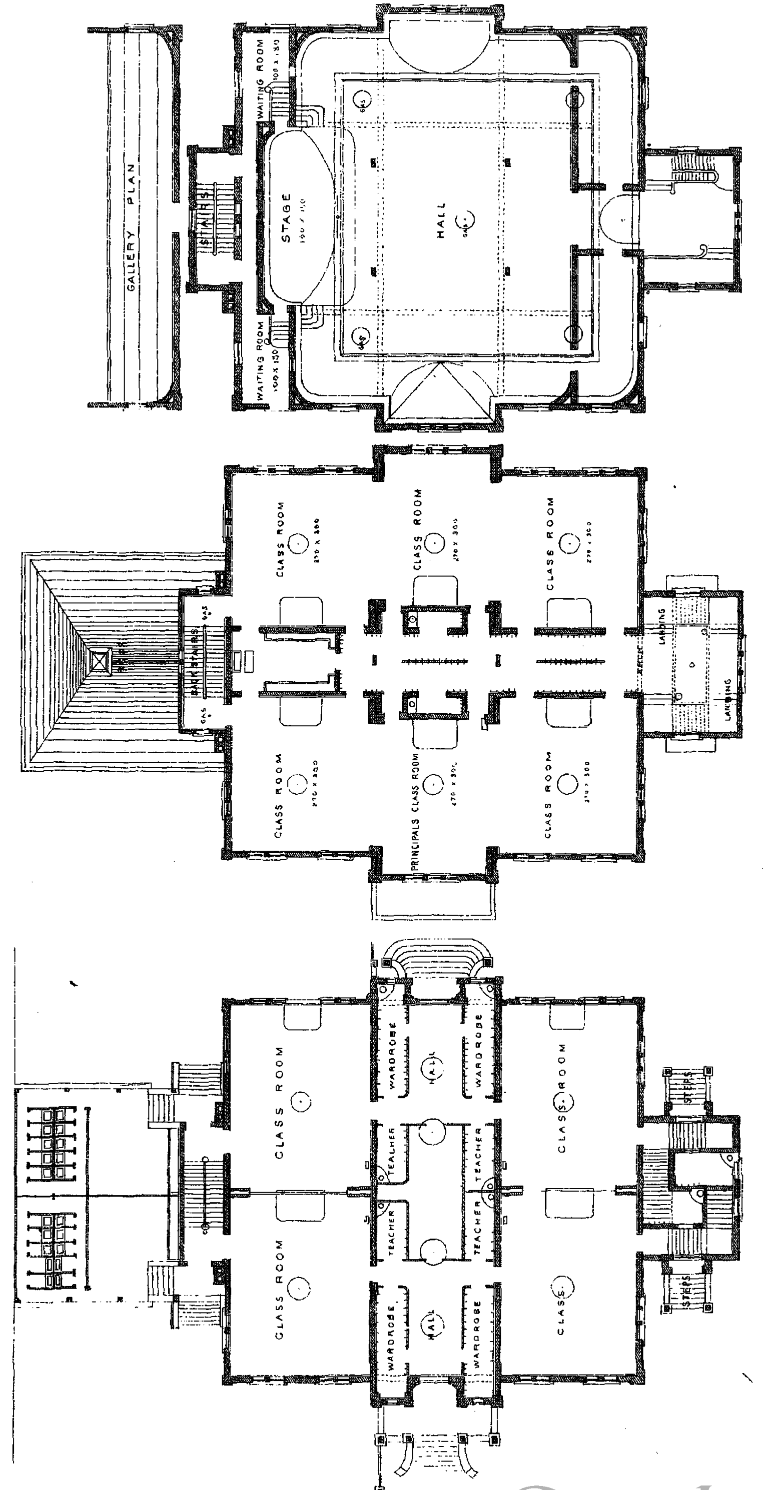
High School.—Number of classes, 4; taught by two male teacher receiving respectively $200 and $150, and two female teachers receivin each $100; total number enrolled, 145; average number belonging, 135 average daily attendance, 133.

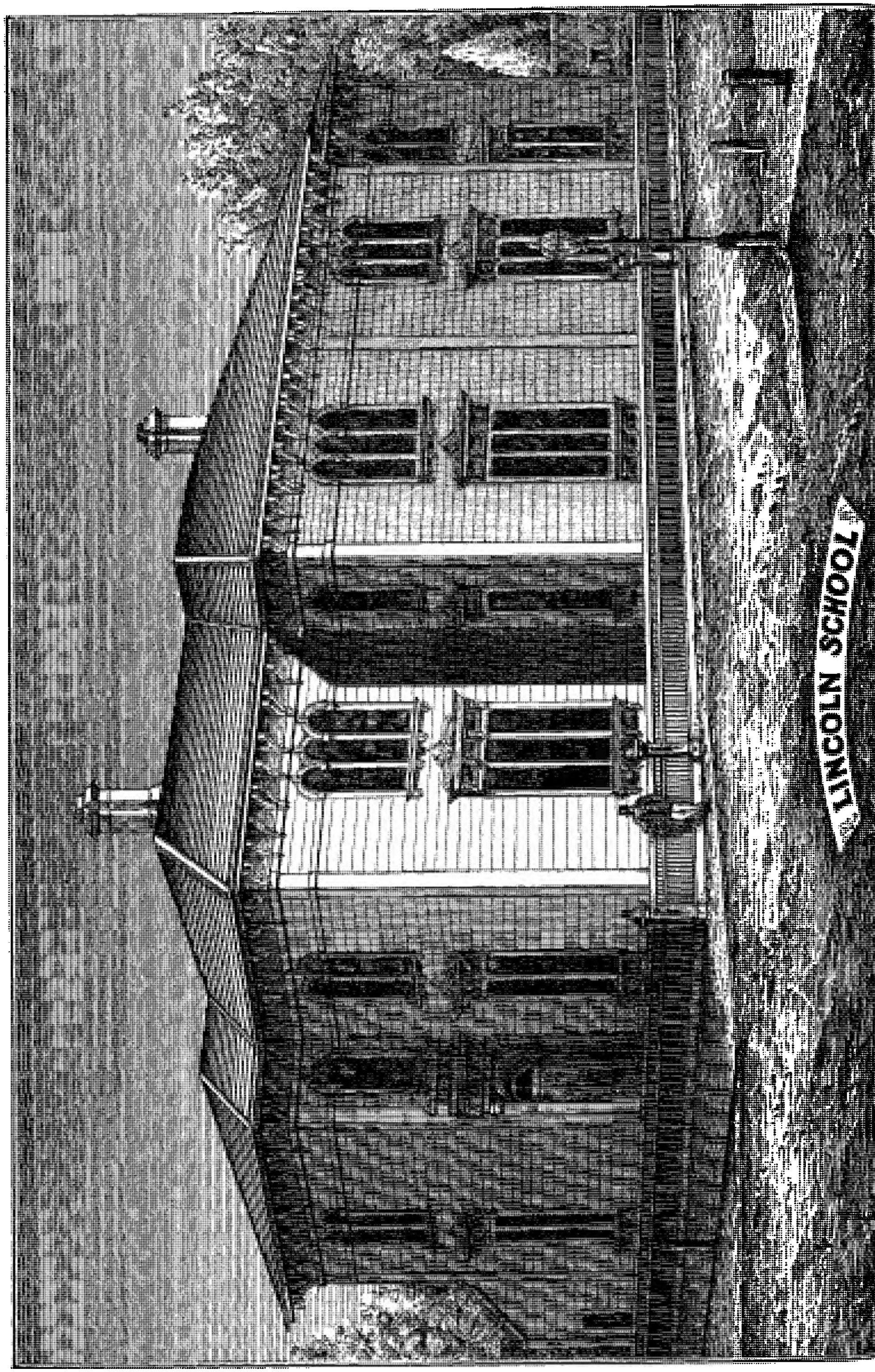
Evening School.—One class, taught by one male teacher receiving $6 per month; total number of pupils enrolled, 48; average number belong ing, 29; average daily attendance, 21.

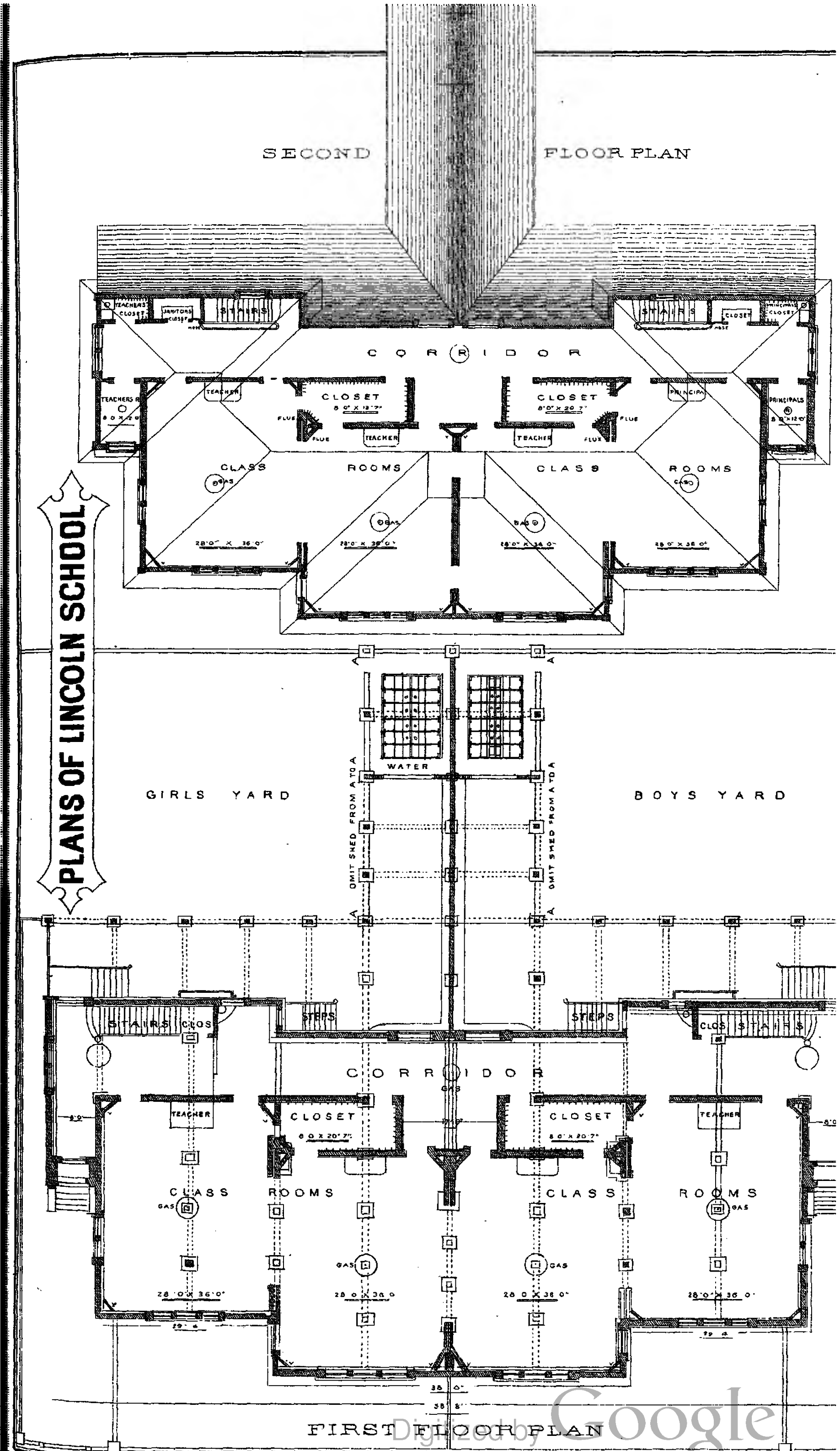
There is no separate school maintained for colored children, as they attend the schools of the white children. The schools are maintaine ten months in the year, except the evening school, which is maintaine only three months. The current expenses for the school year endin June thirtieth, eighteen hundred and seventy-five, were $79,299 63; th expenditures for building and furniture, $28,746 06; total expenditures $108,045 69.

Truancy.—During the last year there were detected and reported one hundred and fifteen cases of truancy; one from the High School, thirty-four from the Grammar Schools, and eighty from the Primary Schools. It is fair to presume that this is considerably below the actual number that occurred. With this it is certainly within the authority of the Board to deal, and I feel satisfied that, in most cases, the Board would have the coöperation of parents in their efforts to prevent or cure it. At present our only mode of dealing with it, after the other ordinary forms of school discipline have failed, is *suspension* or *expulsion*. A boy who is not disposed to go to school, has only to play truant a sufficient number of times, and suspension or expulsion at once relieves him, and places him among the idle and vicious non-attendants. We expel or suspend a boy from school for staying away from it, and would then pass laws to compel him to attend, or punish him for not attending. On the other hand, it is dangerous to retain him. It is not only impossible to secure his regular attendance, but also the performance of duty when present, because if punishment is imposed or threatened, he has but to run away from school and play truant the next day to escape. The difficulty of preventing offenses against good order and propriety is greatly increased by the example of such a boy. Others are apt to fall into his way and spread the contagion. Without stopping to enlarge upon the magnitude of the evil, or the inconsistency of our present mode of dealing with it, I would submit the following brief outline of a plan for its correction and prevention, and also of those other offenses

PLANS OF HIGH SCHOOL




LINCOLN SCHOOL


PLANS OF LINCOLN SCHOOL
SECOND FLOOR PLAN
CORRIDOR
CLOSET
CLASS ROOMS
CLASS ROOMS
GIRLS YARD
BOYS YARD
WATER
OMIT SHED FROM A TO A
CORRIDOR
STAIRS
STEPS
CLOSET
TEACHER
CLASS ROOMS
CLASS ROOMS
FIRST FLOOR PLAN

which are now punished by suspension and expulsion, leaving the details for future elaboration:

1. That there be established, in a convenient locality, an ungraded school of one or more classes.
2. That the school be put in charge of some man of acknowledged ability as an instructor and disciplinarian.
3. That, by a process to be hereafter explained, boys who have so often committed the offense as to be called habitual truants, and those whose conduct is such as to be subversive of good order, shall be remanded to the ungraded school.
4. That those who, during a specified term, shall give unmistakable signs of reformation, may, at the end of that time, be reinstated in the graded schools.
5. That those who still prove incorrigible be handed over to the police magistrate, who may commit them to the Industrial School.
6. That for the better carrying out of the system, the police officers be also known as truant officers, and their duties as such definitely specified.

The process by which a child should reach the truant or ungraded school would be something as follows:

1. For the first offense the teacher notifies the parents and the Superintendent, who shall enter the name and residence of the offender in a book kept for the purpose, and shall, by consultation with parents, etc., try to prevent a repetition. For the second offense, the name and residence of the offender is placed in the book of the truant officers, in the office of the Captain of Police, and these officers shall unite their efforts with those of the teachers and Superintendent in endeavoring to bring about a reformation, by calling upon the parents, and warning them and the boy. Should all their efforts fail, he shall, by the Superintendent, be remanded to the ungraded school.

Some of the benefits of this plan would be:

1. The removal from among others of those whose influence is pernicious.
2. The chances of reformation offered the offenders in place of, as now, the certainty almost of their ruin, by turning them into the streets.
3. The saving of the time of the regular teacher for the legitimate work of the school-room.
4. The prevention of like offenses on the part of others.
5. The economy of the plan. If it is true that truancy leads to idleness, ignorance, and vagrancy, and these to crimes, that is a truly economical investment of money which will prevent the first. The machinery necessary to detect and to punish crime in the United States, involves an expenditure of money, annually, many times larger than that expended for public education.

Free Text-books.—Slate pencils, pens, and ink are furnished gratuitously by the department. Other necessary articles, and all text-books, are required to be provided by the parents. The supplying of books, however, to indigent pupils, is provided for by the following rule of the Board:

"Whenever principals are satisfied that parents are too poor to furnish books, they shall make out a list on the proper blank, which should be signed by the parent, and sent to the Superintendent, who shall furnish the books from the fund provided by law for indigent pupils. The

books so furnished shall be collected by the principals, at the end of each term, and placed in the school library, to be used, as occasion may require, in supplying indigent pupils."

I think it speaks well for the prosperity of this community that, during the year, the cost of books so supplied has been but thirty-six dollars and fifty-four cents.

In some cities, as New York, for example, text-books are furnished the pupils gratuitously. The books, of course, are not *given* to the pupils, but are simply loaned. The plan possesses many advantages. First among them is its economy. In families where there are numbers of children, the supplying of text-books is a severe tax. The accumulation of books in such a family, by the time the children have passed through the several grades, is frequently sufficient to stock a tolerable book store. The books, if carefully used, are not worn out, but are rendered useless by promotions to higher grades and other studies. On the other hand, if the books were owned by the Board and *loaned* to the pupils while in a grade, they would be left, on promotion, as the furniture of the room—the desks, maps, etc., are left for those who would take their places. The books would thus be *worn out*, and not allowed to accumulate in closets and garrets. Moreover, the *parent*, in purchasing a book, has to pay a price, which, in addition to the author's copyright and the publisher's profit, must also furnish a profit to both the wholesale and retail dealers. This last could be saved by the Board purchasing in quantities directly from the publishers. The amount expended comes from the people, whether they themselves buy the books or the Board does it for them. The plan, therefore, which would secure the saving to the community of a very large sum, by comparatively a very small increase of school tax upon the same community, is the one, I think, that must commend itself as sensible and correct.

Second—Saving of time. At the beginning of each new term, much valuable time is next to lost, not only to the individual pupil, but also measurably to the entire class, by parents delaying to furnish their children with the necessary books and supplies. This results sometimes from the carelessness of the children themselves, sometimes from the carelessness of parents, but oftener than either from inability to purchase them at the time. Even tolerable promptness in getting a class supplied with books now, at the beginning of a school year or term, involves great harrassment to the teacher; detentions, punishments, and other petty torments to pupils; and, finally, inconvenience, if not actual hardship, to many parents who will not be the recipients of charity, and ask the department to recognize them as indigent and give them their books. All this, in addition to time saved, could be avoided by having "free text-books."

Third—More careful use of books. If this plan were adopted, the teacher of each class would be charged, by the Principal, with the number of books furnished to her class, and be held responsible for the care of them. Daily or weekly examinations of books by the teachers, would tend to secure their careful use, and, per consequence, the forming of correct habits in this respect by the children.

As it is now, the personal ownership of the books by the pupils operates practically (though theoretically it should not) to relieve the *teacher* of the feeling of responsibility in its care and throw it upon the parent. The feeling on the part of the pupil that "the book is my own, and I will do as I please with it," would give place to "this is a borrowed book, and I must be careful of it." *Parents* would be interested in

the care of the books, because it would be necessary, before a pupil coul be furnished with the books of a higher grade, that he should have, i addition to his certificate of promotion, another, stating that, excep with the necessary wear, the books had all been returned as they wer loaned.

Principals would require that all books missing should be replaced b parents before the new ones were furnished.

Finally, if there should prove to be objections to the foregoing plan which I have failed to see and anticipate, I think there can be non to this modification of it, viz: that on the first admission of a pupil to class, the parent should pay a very small sum (to be fixed definitely fo each grade) *for the use* of the text-books during the year. The sum s charged would have to be but nominal, to realize a sum sufficient t keep the school supplied with books. I would ask the reference of thi subject to the Committee on Text-books.

I have another vague sort of idea in regard to text-books, which ma not at present be practicable for us here in Oakland, and perhaps nc anywhere, and I only throw it out at this time, that it may be though about and talked about a bit, to see if there is anything in it. Perhap some bigger man than I am, in some larger place than Oakland, ma make something of it. In large cities, could not all text-books, excep in the high schools, be dispensed with, and in their stead, could ther not be issued, on the first of each month, from the office of the Superir tendent, in pamphlet form, the work to be done by the grade in eac study during the month? Most writers of text-books make their book as though they were to be used without a teacher (occupying page with explanations and illustrations often more difficult to understan than the original proposition); and many teachers use them in the sam spirit in which they are written. By my plan, there would be printe for the pupils only as much as they are to *study* and *commit*, and not a they were to *learn* of the subjects; for the teachers, only the *limits* an *ground* to be gone over in the subjects, and not all they were expecte to *teach*. Suppose it did make them search their books of reference an scratch their heads for what was to be taught, would it not do them good Would not the uniformity of the instruction given by this plan be a goo point? Would not the frequent meetings of all the teachers of the sam grade in the city with the Superintendent, or his deputy (and these mee ings would form part of my plan), to discuss the definite work in hand, an not impracticable theories, each getting the benefit of everyone else' knowledge of the particular part of the subjects being taught, and goin full of it to the class-room, I say, could this fail to result in good to th schools? In the preparing of the pamphlets, I would have the compos tion, press-work, folding, and sewing done in an office belonging to th Board, and by pupils of the upper grades alternately, or by graduate from the grammar schools, who wish to learn the trade, under a few com petent foremen, and, to this extent at least, solve the problem of "Wha shall we do with our boys?"

Half-time Schools.—Mr. Campbell proposes the following plan for intro ducing the half time system of schools:

First—That each class in the department be separated into two di visions, as nearly as practicable equal in point of numbers. The firs division to contain those who, by length of time in class, age, natura aptness, physical health, or any other cause, are the more advance *now*, or *able* to advance the more rapidly.

Second—That one of these divisions shall come to the school-room a

nine o'clock in the morning, remain until twelve, and then be dismissed for the day. The other division to come at one o'clock in the afternoon and remain until four; or, in the Summer season, perhaps, to come at two and remain till five.

Third—That as there might, and probably would be a choice, as between the morning and afternoon session, the divisions exchange once a month, or in the middle of each term at the week's vacation—that is to say, that which one month attends in the forenoon, shall the next month attend in the afternoon, and vice versa.

Fourth—That as the labors of the teachers will be very materially increased, their compensation should be increased also.

* * * * * * *

First—We could have twice as many grades as now, and more frequent advancement, without increasing the number of school-rooms, or the number of teachers.

Second—Those parents whose circumstances require that a portion of the time of their sons or daughters should be given to some kind of labor, and those also who are able and willing that their children should give some time to the acquiring of accomplishments not taught in the schools, could both be accommodated. And,

Third—We could, without *any* additional expenditure for school sites, buildings, furniture, apparatus, insurance, janitorial work, etc., and but a *comparatively small* increase of salary to teachers, accommodate *twice* as many as now.

On the other hand, grant that the objections are even more numerous and graver than they now appear to be (I think I shall show the reverse is true); and yet the question, it seems to me, may well be asked, if they are greater either in number or magnitude than those which can be urged against what we are now obliged to do, viz: to deny to *some* children *all* school facilities for the sake of retaining others in school for a number of hours each day, which tradition and custom has fixed as the only proper thing. In other words, if we cannot give to all the children of our city as many hours in school each day as we *think* they *ought* to have, should we not be doing the fair thing by giving them as much as we *can*, and yet treat all alike? But would the proposed plan be *actually* so great a reduction of the *necessary* school hours as at first appears? Let us see. The lowest primary grades—the seventh and eighth (containing five hundred and thirty-six of the two thousand eight hundred and fifty-four children in the schools)—are now dismissed at a quarter past two, giving them, exclusive of the recesses (fifteen minutes in the forenoon and one hour at noon), four hours in school. The proposed plan would reduce this time to three hours, or allowing fifteen minutes recess, to two and three quarters hours. In point of fact, however, there would not be so great a loss of time as the difference between four hours and two and three quarters, because their advancement being so different, especially in the eighth grades, no inconsiderable part of their time in the school-room is now lost to them—or worse than lost—by their being obliged to sit and do nothing while others are being taught. It seems to me that in place of a loss there would be an actual gain even of time, if they were divided into two sections, and the teacher could be allowed to give three hours to the training of each, free from the harrassing, not to say cruel necessity, of trying to keep the other little unfortunates in an unnatural condition of quiet and innocence of baby mischief.

In passing let me remind you that we cannot keep them longer than we now do, even if we wished to. The law has very wisely fixed the maximum of time that they may be retained in school each day. Recognizing that the only danger of errors being committed by school officers and parents lay in the direction of the "too much" rather than "too little," the minimum of school hours is not fixed.

The other two primary grades—the fifth and sixth—remain in school till a quarter of three; and all other classes are dismissed at three o'clock. The loss of necessary time in school to those classes also would be much less than at first appears; because, on account of this very thing, this keeping of them in school so many hours, it is forbidden to require much study at home, and, therefore, from three quarters of an hour to one hour and a half is devoted to study. If we could afford to do so, it might, perhaps, be well to build and furnish expensive study-halls, where all might sit and study under the eye, and with the assistance of the teachers, though even this is not so certain. It is just barely possible that this very thing is one of the chief reasons why our school children are not more self reliant—why so many of them will *study*, as they miscall it, until they come to something—perhaps the only thing in the whole lesson that requires study, and then leave that for the kind teacher to explain and make easy for them. But we cannot afford it. And when, for the sake of securing this very doubtful privilege to many, we are obliged to deny, even to a few, all school privileges, it become something more than a doubtful policy. In this view of the case does the objection that the proposed change would require more independent home study seem so great?

Again, for the purpose of giving them, in the afternoon, the hour and a quarter, or the two hours, as the case may be, the children are confined for an hour at noon in the crowded school yards, to bolt a cold lunch, if they are so fortunate, or unfortunate, as to have brought any at all, amid the jostlings of their mates. Aside from the question of health involved; it is at just this time that the vicious and depraved have the most favorable, if not the only opportunity, to inoculate the innocent with their vileness, and spread the contagion. This is an evil, the magnitude of which cannot of course be known, but I am convinced in my own mind that it is much greater than we, any of us, as parents or educators would willingly believe. In inclement weather, this objectionable feature of the "nooning" at school is removed, as the children are retained in the school-rooms, but then it is at the expense of the fresh air and exercise that they need. This suggests again the matter of health. You will remember that in my report to you a few evenings ago it appeared that of the four hundred and twenty-four who had left school during the term, sixty-four had done so on account of sickness; and, no doubt, some of those reported unknown left from the same cause. How much or how little of this sickness was the direct result of this cold lunch "nooning" business, and long hours in school, I cannot know, nor can you; but it is fair to presume that some of it was. And now, is the hour and a quarter, or even the two hours in the afternoon, worth the price we pay for it in these respects? Would it not be better to keep the pupils vigorously employed during the forenoon, and then send them directly home to eat at their own tables, and to be profitably employed during the rest of the day; or even to use the time in the very way that I can see will be urged against the plan, viz: running in the streets. In regard to this last, I do not believe it will increase, but, on the contrary, will diminish, if this system were adopted; and for the reason that if each child were to have the half of each day out of

school, parents would provide for it, in some systematic way; whereas now, the time out of school being but a fragment of the day is not arranged for. Is it not a fact that many of our girls are growing up entirely ignorant of the simplest kinds of needlework and all household duties, simply for want of time in which to give attention to them? How can it be otherwise? As early as eight o'clock in the morning they must leave for school, or begin preparations for leaving, not to return till half-past three to half-past four o'clock in the afternoon; very illy prepared as we may readily believe, to take much interest in anything.

If it were true that the mental development of children was in direct ratio to the hours spent in the school-room, the change of hours herein proposed, even though better for their physical development, might be reasonably objected to by those parents who are concerned only or chiefly about the intellectual growth of their children. But is it true? If so let us be consistent and discuss whether it shall be the eight or ten hour system that should be applied to our schools. It is not true, however, but the reverse is true, and every minute that children are required to be in the school longer than is absolutely necessary, is a positive disadvantage to them mentally as well as physically.

Since the above was written, I came across almost the same expression in the New York *Semi-Weekly Times* of January first, in a sensible editorial entitled "Cruelty to Rich People's Children." In the course of the article the author says: "And if, besides this, his parents are enthusiastically desirous to have him get along rapidly in his education, it should, if possible, increase our sympathy. 'Veels vithin veels, a prison in a prison,' observed Samuel Weller, on seeing a bird cage in the Fleet. Mr. Weller's remarks would apply not inaptly to the case of a good many little boys. A city at best is to them very much of a prison. To confine them in a school-room two or three hours a day more than is at all necessary is not a little suggestive of 'wheels within wheels.' For many of the comforts, and still more of the luxuries which are prized by older people, children generally care but little. There is a certain kind of freedom of movement for which human beings under the age of twelve years have a far greater longing than for French cookery or Axminister carpets. Unduly to deprive a child of this freedom is to take away not only one of his greatest luxuries, but one of his most needed comforts. In a city the privation of much of this liberty is, indeed, unavoidable; but that is all the more reason why additional restrictions should not be needlessly imposed."

There is another class of parents, who will be utterly opposed to the change of school hours that I here propose. They are those who regard schools as conveniences to relieve them from much of the annoyance, if not the care, of their offspring, and who would hail with delight the introduction of a system that should relieve them entirely. Let us hope they are few; but be they many or few, I think we can well afford to offend them, in the interest of their little ones, and leave their wishes entirely out of the discussion.

After all, this whole matter of what best to do for boys and girls reduces itself in my mind back to the old Fabian theory: that the best thing we can do for them is just to *let them grow*. See that they are well housed at night, that they sleep well and plenty, are well fed, have plenty of fresh air and healthful exercise, and *let them grow*. Incidentally, so to speak, or at least without sacrificing any of these things, send them to the very best schools that human wisdom can devise, and funds can be obtained to provide, and let them there be put through a

sensible and vigorous system of mental gymnastics. With the great saving of expense in the matter of buildings could we not do much to make our schools enough better to more than make up to the pupils the loss of an hour or two of time in them? And now what are the serious objections to the change here proposed? Do they not, after all, reduce themselves down to this, that it is an innovation, a departure from long established customs and traditions. Children have always been kept in school so many hours a day, and hence they always should be. Do you really see any much more serious objection than this? It may be urged that this change of school hours would involve a thorough remodeling of our course of study. In view of their complaints (less in Oakland perhaps than anywhere else) concerning what is called cramming superficiality and generally the unsatisfactory results of our present system, is it certain that even this would be an unalloyed calamity? One other objection may be offered. It may be claimed that those who attend in the morning will have very much the advantage of those who attend in the afternoon. That "one hour in school in the morning is worth two in the afternoon," etc. If this is true, the proposition that the sections should change each month or once a term, would equally divide the damages and benefits.

But if it is true that the afternoon hours are of so little value to the pupils, may it not be chiefly because they have exhausted their powers of application during the confinement of the morning session? If they should come into school at one o'clock, for the first time during the day, fresh and vigorous, would not the afternoon hours cease to be so profitless as they are claimed to be now? In place of the little value of the afternoon being offered as an objection to the proposed plan, should it not be regarded as one of its chief merits, that it would reclaim and render productive what is at present so nearly a barren waste of time? I have not consulted with any of the teachers yet in regard to this matter, and so do not know how they will regard the change as affecting them. On general principles, however, I should say that it would meet, generally, with their favor. The compensation paid to teachers is, as a rule, barely sufficient for present support, allowing scarcely any margin with which to provide for future contingencies. I think most of them would therefore be willing, if not anxious, to work a little longer and harder each day for a corresponding increase in their compensation. If any should feel that their health or strength would not permit them to undertake the increased labor, they could be relieved each half day by others who are similarly situated.

LOS ANGELES.

WILLIAM T. LUCKY................................Superintendent.

Total number of census children, June, eighteen hundred and seventy-five, 2,257.

Primary Schools.—Number of classes, 14, taught by two male and 14 female teachers, whose maximum salary is $100, and the minimum, $80. Total number of pupils enrolled, 633; average number belonging, 532; average daily attendance, 504; total annual expense of maintaining schools, $13,000.

Intermediate and Second Grade Schools.—Number of classes, 4, taught

by one male and three female teachers, whose salary is $100. Total number of pupils enrolled, 214; average number belonging, 197; average daily attendance, 187; total annual expense of maintaining schools, $4,500.

Grammar School.—Number of classes, 3, taught by one male and two female teachers, whose salary is $100. Total number of pupils enrolled, 148; average number belonging, 140; average daily attendance, 134; total annual cost of maintaining schools, $3,500.

High School.—Number of classes, 3, taught by one male and one female teacher, the former receiving $300 per month, the latter, $125 per month. Total number of pupils enrolled, 61; average number belonging, 57; average daily attendance, 55; total annual expense of maintaining schools, $4,500.

Colored School.—One class, taught by a male teacher, whose salary is $80 per month. Total number of pupils enrolled, 25; average number belonging, 23; average daily attendance, 19; total annual expense of maintaining schools, $1,000.

All the schools are maintained ten months in the year. No evening school has as yet been established.

Non-attendance.—There is as large a percentage of non-attendance in Los Angeles as in any other incorporated city in California, perhaps larger. The reason for this is found in the character of the population. The native Californians are not willing patrons of schools. Another reason *was* the extent of our territory and the limited number of school houses. The latter reason no longer exists, and it is hoped that the beneficial influences of education will soon become so apparent that all classes will be anxious to educate their children.

Irregularity of attendance.—The causes that produced non-attendance were prolific sources of irregularity of attendance. Excluding the native element in the schools, the remainder will compare favorably in promptness with other communities.

Condition of the Schools.—The general condition is good, with the prospect of gratifying improvement for the future.

Primary Schools.—There are four regularly graded primary classes in comfortable, well furnished rooms, under successful teachers. The seventh and eighth grades are taught by teachers having "four years experience," who receive the same salary that is paid to teachers in the first grade. Is there another city that complies with the *law* in this particular? There are nine schools of *primary* grade in which the four divisions are taught. Five of these are in new buildings just erected in the suburbs of the city. They are in a very prosperous condition.

Intermediate Schools.—There are four classes, all in care of experienced teachers. These classes are crowded with pupils. It is the intention to erect this year two large buildings, one in the northern part of the city, and one in the southern part, for intermediate and primary classes.

Grammar Schools.—There are two classes of forty pupils each in the first division. This number will be increased to fifty in a few days. In the second division there is but one class. It has seventy-two pupils now with a prospect of ninety. It will be divided as soon as a room can be provided for half of it. The grammar classes are in excellent condition, under the care of three very good teachers.

High School.—Three classes are regularly organized, making a three years' course. In the senior class there are six pupils, in the middle class fifteen, and in the junior class forty. This department is *free* to pupils from all parts of this county. This generous offer by our

Board of Education is highly appreciated by parents and teachers. It gives the high school an influence throughout the county, which we hope to use to advance the best interests of education.

Evening Schools.—There are no evening schools in connection with the school department. There is a demand for at least one school, and I expect to recommend the Board to open such a school as soon as the evenings are longer.

Colored Schools.—There is one colored school taught by a white man. It is well attended and is giving general satisfaction. There is an average attendance of twenty-five pupils. The great irregularity of the children prevents any rapid advancement. So far as I have heard an expression of opinion, the negroes prefer a separate school, provided their children have the same advantages that white children have.

Schools for Turbulent Scholars.—I do not believe such schools are necessary or practicable. I am fully convinced that *any person* competent to teach, can so interest pupils that they will be easily governed. Troubles in government arise more from incompetent teachers than from any other cause. It is impracticable, because it is impossible to fix a standard for admission into such schools. To send children to such a school would be to fix a stigma upon them that would in many cases be their ruin.

Co-education of the Sexes.—There is co-education in all our classes and in all grades. When I came here it was different. In grading the schools I paid no regard to sex, and though this community is largely composed of Southern people and Catholics, both supposed to be opposed to co-education, such have been the results of the change that I have not heard of any objections. After an experience of thirty-four years in teaching, thirty-one of which have been in mixed schools, I am fully convinced that the intellectual, moral, and *social* advancement of each sex is promoted by co-education.

Course of Study.—I have tried in different ways to have a uniform course of study in all our high schools. Having failed, I still follow the course laid down in the school law.

Half time Schools.—I am in favor of two kinds of half-time schools. In primary classes of more than fifty, or certainly more than sixty children, I have recommended the division of the class into two divisions, one to attend school three hours in the forenoon and the other three hours in the afternoon. The Board adopted my recommendation, and the plan will go into operation at the beginning of the next month. Five classes will be affected by the change, in which the numbers are now 90, 70, 66, 62, 57.

Second—For boys and girls who have to work a part of every day, I have recommended the opening of a class which they can attend either forenoon or afternoon. In this class you could also place pupils who are behind a certain grade in only one or two studies. To these they could give special attention for a few weeks and thus be enabled to enter a regular class. Such a class will be established as soon as we have the means to sustain it. There are boys and girls now waiting for it.

Promotions.—We have promoted at the end of the year, upon the standing in written examinations during the entire year. This, of course, applies to those above the *primary grades.* This year, I will recommend promotions at the end of each session. To keep a child

back an entire year, whose percentage was *almost* high enough to secure promotion, is to discourage him, and to make him a nuisance in his class and a bother to his teacher, because he is idle much of his time. There are difficulties in the way of promoting some grades semi-annually and others annually. I am not prepared to say how I will overcome them; perhaps it cannot be done.

Examinations.—In all classes above the sixth grade, Wednesday forenoon is devoted to written examinations. Each class has four *leading* studies. By examining the class upon one study each Wednesday, there is an examination upon the four studies each month. A record is kept, and from the aggregate of credits an average is obtained, and upon this basis, promotions are made. In addition, there are *frequent* oral examinations by the teachers, and one by myself at my monthly visit to the class.

MARYSVILLE.

THOS. H. STEEL....................................Superintendent.

Total number of census children, June, eighteen hundred and seventy-five, 1,057.

Primary Schools.—Number of classes ten, taught by one male and five female teachers; salary of male teacher, $100; maximum salary of female teachers, $80; the minimum, $50; total number of pupils enrolled, 377; average number belonging, 261; average daily attendance, 240; total annual cost of maintaining schools, $5,171.

Intermediate or Second Grade Schools.—Number of classes, four, taught by one male and one female teacher, the former receiving $120 per month, the latter, $90 per month; total number of pupils enrolled, 132; average number belonging, 92; average daily attendance, 84; total annual expense of maintaining schools, $2,579.

Grammar Schools.—Number of classes, four, taught by one male and one female teacher; the former receiving $150 per month, the latter, $110; total number of pupils enrolled, 83; average number belonging, 57; average daily attendance, 51; total annual cost of maintaining school, $3,249.

High School.—Number of classes, taught by one male teacher, whose monthly salary is $180; total number of pupils enrolled, 28; average number belonging, 21; average daily attendance, 20; total annual cost of maintaining school, $2.298.

Colored School.—Three classes, taught by one female teacher, receiving $75 per month; total number of pupils enrolled, 38; average number belonging, 25; average daily attendance, 23; total annual expense of maintaining school, $892.

All the schools are maintained ten months in the year; no evening school has as yet been established.

Non-attendance.—The evil of non-attendance is the greatest with which we have to contend in the public schools of Marysville. According to the report of the School Census Marshal, in June last, there were four hundred and thirty-one children in the city who had not attended school at any time during the school year ending on that month. The Census Marshal, however, was informed that very many of these children had quite recently arrived from Missouri, Kansas, Arkansas, and other Southwestern States; the report, therefore, makes a showing less favorable to Marysville than it would have made had it been made in April, or even in May. Still, the number of non-attendants is large, compared with the school population of the city. The law, enacted to enforce the educational rights of children, so effectually guards against any encroachment upon the rights of parents, that it utterly fails to accomplish the purpose for which it was enacted. In my opinion, the law should be amended so as to meet cases in which parents claim to be too poor to send their children to school. In such cases, I would have the State take possession of the children, feed, clothe, and educate them, from seven to fourteen years of age.

Irregularity in Attendance.—While the evil of non-attendance at school, in the form of hoodlumism, is felt by the whole community, that of irregularity in attendance is most keenly felt within the walls of the school-room. The brightest pupil of a class can afford to be absent a day at a time, occasionally, for he is able to, and *will* make up the loss he has suffered; but the names of bright pupils are seldom found on the roll of absentees; the dull and comparatively thoughtless pupils are most frequently absent. I believe the principal remedy for this evil lies in the teacher. He must be able to awaken an interest in the minds of *even the dull* ones of his school. He must visit parents, and convince them of the loss their children sustain by being absent, and of the demoralizing effect that their absence has on the other members of their classes.

General Condition of the Schools.—Notwithstanding the calamity of the flood with which our city was visited in January last, and the high rate of levee tax which consequently followed, the people still continue to pay a liberal tax for the support of our city schools; and the popular interest in the cause of education has not in the least abated. Comparing the present condition of our schools with that of a year ago, the primary schools have made the most improvement. I do not intend to say that they are better than the others at present, but that formerly they were much worse. Our primary teachers have been too apt to congratulate themselves and one another on their success, when their pupils were able to repeat the printed answer to the printed question in the text-book, even when the pupil did not know the meaning of his answer nor of half the words that composed it; a fact which was readily discovered by asking some pertinent question not found on the printed page. Spelling.—In the matter of spelling, we have made great improvement. Formerly the rule was that the pupil should correctly spell a great many words, and frequently he did not know the meaning of one in five of the words that he spelled. Now we teach the pupil the meaning of the word first, afterward we teach him how to spell it. What we need most at the present time is to have an educator of large experience in the matter of primary instruction, to go into our primary schools and give the teachers samples of his method of teaching. This, I, as City Superintendent, have frequently done, but they still have need of special instruction.

Co-education of the Sexes.—Except in the Colored and the High School the sexes are separately educated. In the Colored School pupils remain until they are qualified to enter the intermediate schools. We have no need for separate schools for troublesome pupils. We are pretty well satisfied with the State course of study. I believe that half-time schools are the very best remedy for the evil of overcrowded school-rooms. In primary schools pupils should be promoted from grade to grade on oral

examinations, and, in the higher grades, on oral and written examinations combined.

STOCKTON.

Geo. S. Ladd.......................................Superintendent.

I have received only the following statistical information concerning the school department of this city: Number of census children, June, eighteen hundred and seventy-five, 2,053.

Primary Schools.—Twenty two classes, taught by 15 female teachers, receiving each $75 per month; total number of pupils enrolled, 1,398; average number belonging, 699; average daily attendance, 627; total annual expense of maintaining schools, $11,650.

Intermediate or Second Grade Schools.—Five classes, taught by 5 female teachers, receiving each $80 per month; total number of pupils enrolled, 523; average number belonging, 270; average daily attendance, 245; total annual cost of maintaining schools, $4,400.

Grammar Schools.—Number of classes, 6; taught by 5 male and 3 female teachers—one male teacher receiving $120 per month, the rest of the teachers receiving each $90 per month; total number of pupils enrolled, 646; average number belonging, 297; average daily attendance, 276; total annual cost of maintaining schools, $6,700.

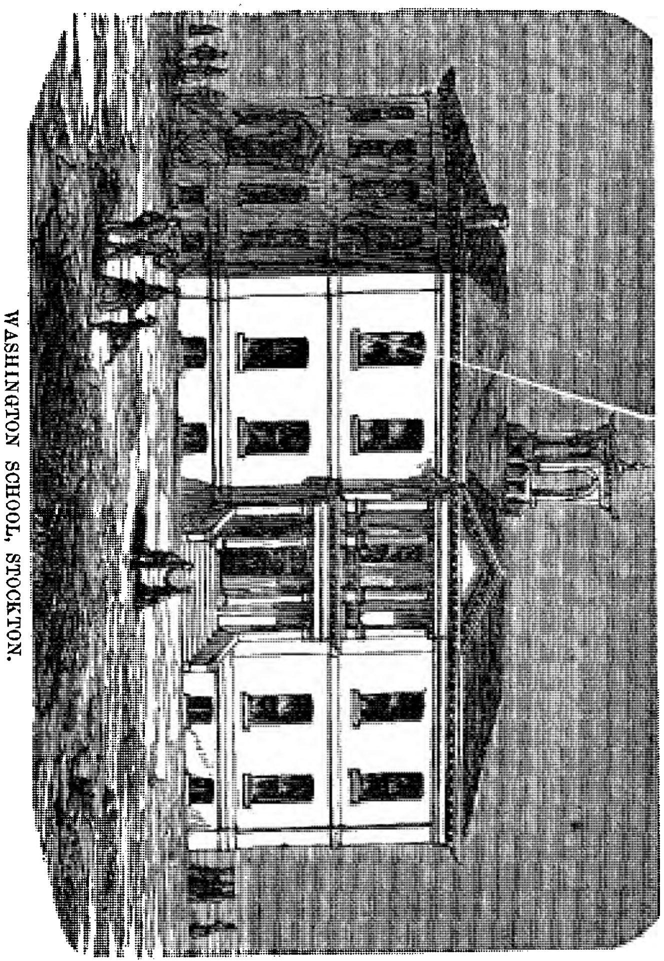
High School.—Three classes, taught by 2 male teachers, one receiving $200 per month, and the other $170; total number of pupils enrolled, 94; average number belonging, 65; average daily attendance, 61; total annual cost of maintaining schools, $3,800.

Colored School.—Three classes, taught by one female teacher, receiving $70 per month; total number of pupils enrolled, 30; average number belonging, 27; average daily attendance, 22; total annual cost of maintaining school, $725.

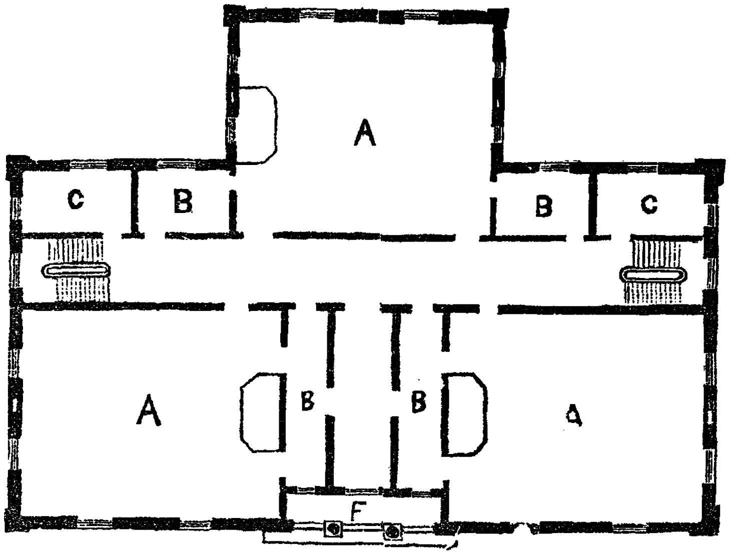
All the schools are maintained ten months in the year; no evening school has as yet been established.

Washington School House, Stockton.—This is a substantial brick structure, fifty-four feet by ninety-five feet, with a wing in the rear, eighteen feet by thirty-eight feet, and is located on the corner of San Joaquin and Lindsay streets, in the City of Stockton. The building is two stories in height, with a basement, and contains six class rooms—three of which are located upon each floor, with teachers' and wardrobe rooms attached. Ample means of communication with every portion of the interior are provided for by the main front entrance and the two side entrances in the ends of the building, and thence by spacious halls and stairways connecting the different portions of the same. The arrangements are such as to afford every facility for the separation of the sexes in approaching and retiring from the school, and the plan of the building is admirably calculated for the preservation of order, and the inculcation of sound morals among the pupils. The fullest provision has been made for the admission of light and air, and nothing has been omitted that is conducive to the moral, intellectual, and physical welfare of the children in attendance. The basement, which was specially designed and arranged with that view, affords every facility for the healthful exercise and innocent recreation of the pupils, and nothing has been neglected in any department that

could at all contribute to render this, in all its details, a first class institution, and in every way fitted for the purpose for which it was specially designed.



WASHINGTON SCHOOL, STOCKTON.



SECOND STORY.

AAA—Recitation Rooms. BBBB—Clothes Rooms. CC—Teachers' Rooms. F—Balcony.

SANTA CLARA.

A. MADAN..Superintendent.

Number of census children, June, eighteen hundred and seventy-five, 614.

Primary Schools.—Four classes, taught by 4 female teachers, receiving each $70 per month; total number of pupils enrolled, 320; average number belonging, 181; average daily attendance, 164.

Grammar School.—Four classes, taught by 2 female teachers, receiving each $70 per month; total number of pupils enrolled, 99; average number belonging, 66; average daily attendance, 61.

High School.—Two classes, taught by 1 male teacher, receiving $125 per month; total number of pupils enrolled, 30; average number belonging, 19; average daily attendance, 19.

The total annual expenses of maintaining all the schools of the city, are $7,000; the schools are kept open ten months in the year; no separate school has been established for colored children; no evening school has yet been established.

Non attendance.—This, like other places, contains some persons who are careless concerning the sending of their children to school. There are one hundred and thirty-six who do not go to any school. There are many who go to the numerous private schools and colleges, thereby lessening the number that go to the public school. The number enrolled in the public school last year, was four hundred and forty-nine.

A few are irregular in attendance. They go for a few weeks, become tired, quit, and go to some private school, to find an easy place. Trying several schools, and finding none to suit them, they try the streets for a time.

The general condition of the schools is good. The deportment of pupils is generally very good. There are but few who annoy the teachers or disturb other pupils.

Only one colored pupil—a girl eleven years of age—has applied for admission, and she is admitted to the school for whites.

With a separate school for five turbulent, troublesome, and truant boys, the rest would make a most pleasant school, and the teacher would have a most delightful occupation; but, since there are so few bad ones, the expense would be too great to have a separate school, unless the compulsory law should be enforced, thereby bringing a few more from the streets, and making an ungraded school, in charge of one teacher. The teachers of the public school recommend such a school, and one of the young ladies, now teaching in the public school, offers to take charge of such separate school.

The boys and girls go to the same school, and recite and study together; but have separate playgrounds. The co-education of the sexes works most favorably, cultivating a desirable emulation, and conducing to good morals and manners.

The State course of study gives satisfaction.

We have no half-time schools. They might be desirable where pupils could go a part of the day, when they are otherwise employed the rest of the day.

The pupils whose average monthly standing, combined with their final examination, is eighty per cent or more, are advanced. The senior class graduate on the same per cent. Some special cases are subject to special action of the Board of Education.

VALLEJO.

J. G. LAWTON..Superintendent.

Number of census children, June, eighteen hundred and seventy-five, 1,636.

Primary Schools.—Number of classes, 7, taught by 7 male and 6 female teachers. Salary of male teachers, $10[illegible]; maximum salary of female teachers, $80; minimum of salary of female teachers, $55. Total number of pupils enrolled, 650; average number belonging, 416; average daily attendance, 380.

Intermediate or Second Grade Schools.—Five classes, taught by one male and five female teachers, the former receiving $80 per month, and the latter $75 as the maximum, and $50 as the minimum. Total number of pupils enrolled, 318; average number belonging, 251; average daily attendance, 234.

Grammar School.—Four classes, taught by three male and one female teacher, the former receiving $125 as the maximum, and $80 as the minimum, the latter receiving $70 per month. Total number of pupils enrolled, 216; average number belonging, 176; average daily attendance, 166.

High School.—Three classes taught by two male teachers, receiving $150 and $125 per month, respectively. Total number of pupils enrolled, 80; average number belonging, 77; average daily attendance, 75.

Total annual expense of maintaining the above schools, $22,206. The schools are kept open ten months in the year. No separate school for colored children. No evening school has been yet established.

The course of study followed in our primary and grammar schools is about the same as that adopted for the schools of the State by the State Board of Education.

The course of study adopted for our high school is as follows:

Junior Year.—English Grammar, Ancient History, Algebra and Latin, with Constitution and Government of the United States, Declamations, and Compositions on Fridays.

Intermediate Year.—Rhetoric, Physiology, Elocution, Geometry, and Latin, with Mental and Moral Philosophy, etc., on Fridays.

Senior Year.—English Literature, Arithmetic reviewed, Natural Philosophy, Geology, Botany, and Latin, with Astronomy, etc., on Fridays.

Many boys at fourteen to seventeen years of age leave our schools to become apprentices on the Navy Yard, at Mare Island, or to enter upon some other employment, and thus comparatively few have graduated from our high school.

There seems to be no particular necessity for a special school for turbulent or troublesome pupils. Skillful teachers of experience are able to control all our boys and girls. There has been no case of expulsion from any of our schools during the past two years.

PETALUMA.

WILLIAM ELDER.......Secretary of the Board of Education.

Only the following statistics have been received concerning the schools of this city:

Number of census children, June, eighteen hundred and seventy-five, 833.

Primary Schools.—Twelve classes, taught by 6 female teachers, receiving $60 per month as the maximum and $50 per month as the minimum salary; total number of pupils enrolled, 438; average number belonging, 280; average daily attendance, 271; total annual cost of maintaining schools, $3,350.

Intermediate or Second Grade Schools.—Five classes, taught by 4 female teachers, receiving each $55 per month; total number of pupils enrolled, 227; average number belonging, 173; average daily attendance, 167; total annual cost of maintaining schools, $2,200.

Grammar School.—Two classes, taught by 1 male and 1 female teacher, the former receiving $125 per month, the latter $70 per month; total number enrolled, 107; average number belonging, 74; average daily attendance, 71; total annual cost of maintaining school not given.

High School.—Three classes, taught by 1 male and 1 female teacher, the former receiving $150 per month, the latter $90 per month; total number enrolled, 73; average number belonging, 52; average daily attendance, 50; total annual cost of maintaining school, $2,229.

Colored School.—Three classes, taught by one female teacher, receiving $45 per month; total number enrolled, 15; average number belonging, 11; average daily attendance, 11; total annual expense of maintaining school, $450.

All the above schools are maintained ten months in the year. No evening school has yet been established.

STATE BOARD OF EDUCATION.

STATE BOARD OF EDUCATION.

Since the last report published by this department, the Board h done merely routine work. The revised course of studies adopted l the Board in eighteen hundred and seventy-three, went into effect Ja uary first, eighteen hundred and seventy-four. For the convenience teachers, I reprint the remarks published in the last report, and in t: CALIFORNIA TEACHER, together with the articles on *Arithmetic*, *Geogr phy, and Botany for Schools*, as these articles are frequently asked for l school officers, and cannot be furnished them in any other way.

The course of study as it now stands is not claimed to be perfect, n even what the wants of popular education require, but it is the be course which could be introduced in the present condition of o schools and the teaching profession. It is one step towards rescuing o schools from that text-book system whose highest realization can on insure to the pupil an acquisition of the "realized wisdom of the race and which usually realizes only the "text-book-crammed pupil leavir school with disgust for books." The revised course recognizes that tl child's destiny is activity, as Froebel expresses it; and a child mu conquer knowledge, discover facts and truths for itself, though the fac and truths be known to the world since the dawn of the human inte lect. The child, in order to acquire intellectual power, must exerci intellectual power, and not be a mere passive recipient. The mastery the printed page is one of the objects in school education, but the mo important object is to teach the child how to gain a mastery of tl knowledge inscribed on the page of every-day life.

As far as the revised course has been introduced it has obtained gener approbation, and "it is credited with being more rational and bett calculated to enlist the thinking faculties of pupils than the system will supplant." In the Eastern States the course has been highly con mended. Some of our California cities have incorporated its most in portant features into their course of studies.

COURSE OF STUDIES FOR THE PUBLIC SCHOOLS OF CALIFORNIA.

[Adopted by the State Board of Education, February 14th, 1873, and required to be enforced January 1st, 1874.]

COURSE OF STUDIES FOR THIRD GRADE.

FOURTH DIVISION.

Reading, taught from McGuffey's Primary Charts (or Willson's Charts, where they are already in the school), and from McGuffey's First Reader to page 32. Word method to be used exclusively, according to instructions given in Calkins' *Object Lessons*, page 288, *et seq.* From the very first the proper phrasing of sentences to be attended to, and correct modulations of the voice to be cultivated. Phonic elements of words to be derived by analysis; the letters representing those elements to be pointed out and learned, and finally combined into new words. Punctuation marks, inflection marks, as far as they occur in the reading lessons.

Spelling.—A few words to be first learned by the word method, then the letters composing those words to be pointed out and learned. Words spelled as learned; printing the words of lessons at dictation. The minimum requirement is the ability to spell orally, or print at dictation, any word occurring in the reading lessons.

Printing letters and words as learned, on slate and blackboard (using a long pencil on the slate, that the pupil may hold it in the manner of a pen). Printing words at dictation.

Arithmetic.—Clear and ready perceptions of numbers from one to ten to be developed with use of objects, and at every successive step, all possible additions, subtractions, multiplications, and divisions of integral numbers to be learned within each limit as it is reached.

Object Lessons.—First two weeks: *Form*, Calkins' *Object Lessons*, page 49 to 59. Second two weeks: *Color, ibid.*, page 112 to 118. Third two weeks: *Size and Weight, ibid.*, page 160 to 164, page 176 to 178. Fourth two weeks: *Sounds, ibid.*, page 183 to 188. Fifth two weeks: *Place, ibid.*, page 245 to 246. Review. The rest of the session or term: *Lessons on Human Body*, as given in the *Manual*, alternating with *Lessons on Objects*, Calkins' *Object Lessons*, page 298, *et seq.*, and Sheldon's *Lessons on Objects*, page 20 to 46. Parts, names, and number of parts.

Language.—The pupil to be required to answer and speak in complete sentences. Spontaneous expression of the pupil's thoughts to be encouraged. Systematic correction of common faults in the use of language to be commenced in this, and continued through all succeeding divisions.

THIRD DIVISION.

Reading.—McGuffey's Charts and First Reader completed. Continu drill upon the phonic elements of words; phonic spelling of all wor used in the Reader. Silent letters, long and short vowels, their mai ing. Punctuation marks, and inflection marks, as they occur in readi lessons.

Spelling, oral, written, and phonic, of all words occurring in the rea ing lessons. The minimum requirement is the ability to spell orally, write at dictation, any word occurring in the reading lessons.

Arithmetic.—Exercises, mental and written, in addition, subtractic multiplication, and division of numbers from ten to twenty-five, in cc tinuation of the work laid down for the preceding division. Clear a ready perceptions of numbers from ten to one hundred, to be develop with use of objects.

The child having obtained clear perceptions of the numeration of ter the same work must be performed upon them, which, in the precedii division was performed upon units, but with this difference: that wh tens are to be added to tens, or subtracted from tens, they are to multiplied or divided by no number exceeding nine.

Writing, reading lessons on slate and blackboard. Minimum requi ment to write at dictation any word or paragraph of reading lessc Capitals and small letters.

Object Lessons.—First two weeks: *Form*, Calkins' *Object Lessons*, pa 60 to 74, excepting lesson VI. Second two weeks: *Color, ibid.*, page 1 to 134. Third two weeks: *Size* and *Weight, ibid.*, page 165 to 173, 1 to 181. After this, lessons on objects, alternating with lessons on ai mals and plants, as prescribed in special instruction given in *Manu* Names, position, and uses of parts.

Composition.—At first merely imitative. Copying words and sentenc printed on the blackboard by the teacher. Use of period at end every sentence, and use of capital in first word of every sentence. T children are to be encouraged to write sentences of their own as so as the number of words learned will permit. Just as soon as a fe names of objects, a few words expressive of quality, and a few wor of action are learned so that they can be read and written, let suc objects be exhibited and such actions performed in the presence of t child as shall require, in description or narration, the use of the wor learned. Great care must be taken not to make these exercises difficult as to discourage the children. Spontaneous efforts, even t rudest, should be freely praised.

Geography.—Special local geography, as per instruction in *Manu* Part of object lessons.

SECOND DIVISION.

Reading.—McGuffey's Second Reader begun and completed. Phon exercises as given in Reader. Words and consonants; their marking Punctuation marks finished. Abbreviations as they occur in readi lessons. Distinction between Roman letters and italics; words a syllables; prose and poetry.

Spelling.—All words occurring in reading lessons to be spelled l sound, and by letter orally and in writing. Minimum requirement spell orally or write at dictation any word or paragraph of the readir

lessons. The pupils should be able to spell and to write the names of the days of the week, and, as they occur, the months of the year.

Writing.—Reading lessons on slate and blackboard. *Elements* and *principles* of letters from Payson, Dunton & Scribner's Charts, or from instructions from the copy-book covers, or from Payson, Dunton & Scribner's *Manual.*

Arithmetic.—Exercises in notation and numeration to one thousand. Exercises, mental and written, in addition, subtraction, multiplication, and division of numbers within one hundred, the sum or product in no case to exceed one hundred. In addition, subtraction, and multiplication, the units to be added, subtracted, or multiplied first; then the tens; principles of carrying forward and borrowing illustrated. In division, the tens to be divided first, then the units. Multiplier and divisor not to exceed nine. Same operations to be performed upon hundreds as performed in preceding divisions upon units and tens. Ideas of vulgar fractions to be developed, notation of same to be taught to ninths. Same operations upon these fractions as upon the numbers from one to ten in the Fourth Division of this grade. Roman numerals to C. Robinson's Progressive Primary Arithmetic to page forty-two, at option of teacher.

Object Lessons.—Lessons on harmony of colors, etc. See Willson's *Manual,* page 92, *et seq.*, and Calkins' *Object Lessons,* page 105 to 111. Lessons on *Form,* Calkins', page 74 to 93, and Lesson VI, page 66. Lessons on objects continued. Lessons on animals and plants, as per instruction in *Manual.* Description of parts.

Composition.—Writing sentences containing given words. Pupils to describe the pictures in their Reader, and to be encouraged to tell what they show. Short descriptions derived from these pictures and from object lessons. Accounts of things done. Every child in this division should be able to write his own name, the name of his teacher, and of the nearest Post Office. Systematic exercise in the use of *have, do, be, see,* and in correction of common faults in the use of the same. The work of the term or year should make the pupil acquainted with the use of capitals for the pronoun I, and in the beginning of sentences, in the names of persons, days of the week, the month; also, the use of the period and the interrogation mark.

Geography.—Higher local geography as per instruction in *Manual.*

FIRST DIVISION.

Reading.—McGuffey's Third Reader begun and completed. Exercises as given in preceding division.

Spelling.—All words of reading lessons to be spelled by sound, and by letter orally and in writing. Particular attention paid to the writing at dictation of paragraphs of reading lessons.

Penmanship.—Reading lessons written on slate and blackboard. Numbers one and two, copy-books, Payson, Dunton & Scribner's Series. Instructions on the copy-book cover, and in Payson, Dunton & Scribner's *Manual,* to be followed strictly.

Arithmetic.—Numeration and notation to millions. Exercises in addition and subtraction. Multiplication and division of numbers to one million, multiplier and divisor not to exceed nine. Reduction of mixed numbers to improper fractions, and the contrary. Division of fractions having one for numerator by whole numbers (divisor not to exceed nine) illustrated objectively. Roman numerals finished. Robinson's Progressive Primary Arithmetic, finished, at option of teacher.

Object Lessons.—Lessons on animals and plants, as per instruction in *Manual.* Characters of families.

Composition.—Writing sentences containing words selected from the reading lessons. Descriptions derived from object lessons and pictures. Narration of actions performed by the teacher and by the pupils under the direction of the teacher. Punctuation marks as needed.

Geography.—Higher local geography, as per instruction in *Manual.*

COURSE OF STUDIES FOR SECOND GRADE.

SECOND DIVISION.

Reading.—McGuffey's Fourth Reader to page 126, inclusive. Phonic and elocutionary exercises as given in Reader. The four principal feet of poetry—Iambus, Troche, Anapest, and Dactyl—pointed out as they occur. Poetry to be scanned before being read.

Spelling.—From the reading lessons, as in preceding divisions; also spelling of all technical terms introduced in the several branches taught.

Penmanship.—Reading lessons written on slate. Numbers three and four copy-books, Payson, Dunton & Scribner's Series. Instructions on copy-book covers, and in P., D. & S's *Manual* to be followed strictly.

Arithmetic.—Numeration and notation of integers completed; numeration and notation of decimals so far as given in Robinson's *Rudiments of Arithmetic.* Long multiplication and division; reduction descending and ascending. Rudiments of Arithmetic, to page 166, leaving out *Fractions,* page 74 to 101. Colburn's Intellectual Arithmetic to Section 6.

Object Lessons.—Lessons on animals and plants, as per instruction in *Manual.* Characters of orders.

Composition and Oral Grammar.—Writing sentences containing nouns, verbs, and adjectives, and selecting the same from the Reader. Writing sentences predicating actions and qualities of given objects, selecting words from the Reader which denote action and quality. Predicating action in time past, present, and future; introducing modifiers of the verb (adverbs) to tell where, how, and when. The adverb.—Selecting words from the Reader which denote action present, past, and future. Composition based on object lessons and geography lessons. Use of punctuation marks.

Geography.—Monteith's Manual to South America and California and Pacific Coast. Map drawing on the slate, blackboard, and paper. Local geography continued.

FIRST DIVISION.

Reading.—McGuffey's Fourth Reader completed. Phonic and elocutionary exercises as given in Reader.

Spelling.—From reading lessons, and spelling of all technical terms introduced in the course of instruction.

Penmanship.—Payson, Dunton & Scribner's No. 5. Instruction on copy-book cover and in P., D. & S's *Manual.*

Arithmetic.—Robinson's Rudiments completed, including the portion omitted in the preceding division. Colburn's Intellectual to Section 11.

Object Lessons.—Classification of animals and plants. Instructions in *Manual.*

Composition.—Exercises in narration. Descriptive exercises to be commenced. Geography lessons and object lessons will furnish abundant material. Letter writing. Use of punctuation marks.

Grammar.—Oral deduction of rules for changing nouns from singular to plural. Distinction between the forms of the adjectives denoting different degrees of quality. Subject and predicate to be introduced. Selection from the Reader of the parts of speech already introduced. Personal pronouns, conjunctions, and interjections. Synthetic exercises, embracing modifications of subject and predicate, to be introduced as rapidly as the progress of the class will permit. Person and gender of nouns and personal pronouns.

Geography.—Monteith's Manual completed. Map drawing and use of globe continued.

COURSE OF STUDIES FOR FIRST GRADE.

SECOND DIVISION.

Reading.—McGuffey's Fifth Reader to page 168, inclusive. Elocutionary exercises as given in Reader.

Spelling.—From reading lessons. Swinton's Word Analysis to page 52.

Penmanship.—Payson, Dunton & Scribner's No. 7.

Arithmetic.—Robinson's Progressive Practical to Percentage. Colburn's Intellectual.

Physiology.—Oral instruction as laid down in *Manual.*

Natural Philosophy.—Oral instruction as per *Manual.*

Composition.—Narrative and descriptive exercises extended. Letter writing from pupil to pupil, pupil to teacher, and pupil to parents and absent relatives, on the business and lessons of the school. Manner of addressing letters.

Grammar.—Synthetic exercises; the subject modified by words and phrases. The predicate modified by the same. The adjective and adverbial element to be modified. The verb—transitive and intransitive. The objective element. Introduction of case. Regular and irregular verbs. The clause to be introduced. Selections from the Reader of all the parts of speech. Verb—active, passive, and neuter. Tense. Analysis of simple sentences. The subject a word, phrase, and clause; the predicate a noun, an adjective, a verb. Use of Brown's First Lines of English Grammar, to page 74, at option of teacher.

Geography.—Monteith's Physical and Intermediate. Map drawing. Specimen maps monthly.

History of United States.—Swinton's Condensed, to Revolutionary War. Short Lessons on the Constitution of the United States.

FIRST DIVISION.

Reading.—McGuffey's Fifth Reader completed. Elocutionary exercises as given in Reader.

Spelling.—Spelling from reading lessons as in preceding divisions. Swinton's Word Analysis finished.

Penmanship.—Replaced by Hanaford & Payson's Bookkeeping by Single Entry.

Arithmetic.—Robinson's Progress've Practical and Colburn's Intellectual completed and reviewed.

Physiology.—Oral, or at option of teacher, Cutter's First Book, begun and completed.

Natural Philosophy.—Oral, or at option of teacher, Hotze's First Lessons in Physics.

Composition.—Narrative and descriptive exercises extended. Business letters may take the place of other letters.

Grammar.—Brown's First Lines completed.

Geography.—Monteith's Physical and Intermediate reviewed and completed. Map drawing. Specimen maps monthly.

History of the United States.—Swinton's Condensed completed. Constitution of the United States and of California.

COURSE OF STUDIES FOR THE ADVANCED GRADE.

THIRD DIVISION.

Reading.—McGuffey's Sixth or High School Reader begun.
Arithmetic.—Robinson's Higher completed.
Algebra.—Robinson's New Elementary begun.
Geometry.—Robinson's Separate begun.
History.—Worcester's General begun.
English Composition.—Bonnell's begun.
Physiology.—Cutter's Larger begun.
English Grammar.—Brown's Institutes begun.
Natural Philosophy.—Quackenbos' begun.
Botany.—Gray's Manual begun.
Rhetoric.—Boyd's begun.
Bookkeeping.—Hanaford & Payson's Single Entry finished. Double Entry begun.

SECOND DIVISION.

Reading.—McGuffey's Sixth or High School Reader completed.
Algebra.—Robinson's New Elementary completed.
Geometry.—Robinson's Separate completed.
History.—Worcester's General completed.
English Composition.—Bonnell's completed.
Rhetoric.—Boyd's completed.
English Literature.—Collier's begun.
Botany.—Gray's Manual completed.
Bookkeeping.—Hanaford & Payson's Double Entry completed.
Chemistry.—Steele's begun.
Mineralogy.—Comstock's begun.
Astronomy.—Loomis' begun.
Latin and Greek.—(Optional) begun.

FIRST DIVISION.

English Literature.—Collier's completed.
Mental Philosophy.—Upham's begun and completed.
Chemistry.—Steele's completed.
Mineralogy.—Comstock's completed.
Astronomy.—Loomis' completed.
Surveying.—Robinson's begun and completed.
Plane Trigonometry.—Robinson's begun and completed.
Natural History.—Tenney's begun and completed.
Latin and Greek.—(Optional) continued.

[The Course of Studies for the Advanced Grade was expunged by the Board at the meeting held June first, eighteen hundred and seventy-five, and every Board of Trustees or Education has the power to prescribe the course best suited to its school. I have retained the old course, however, as many Boards may elect to use it in whole or in part.]

PROGRAMME FOR TEACHING THE COURSE OF STUDIES.

Every teacher should have posted up in the school-room an established order of exercises for each day in the week, assigning a definite time for the beginning and ending of every exercise, and of every interval between the exercises; and this order should assign definitely, also, the times for study and topics of study, as well as of recitation.

It is impracticable to establish a uniform rule respecting the frequency and length of recitations; this will depend altogether upon the number of divisions a teacher has to teach. In deciding what proportion shall be given to the different studies, or their branches, the general rule should be that, whatever branch a division is less advanced in, let that particular branch receive special attention till it is as familiar as the other branches. It is very common to find a class more advanced in reading than in numbers, and still devoting less attention to arithmetic than to reading. The observance of the above rule will correct all such errors.

Many teachers seem to think that every branch prescribed by the course of studies must be made a *daily* study. This may be practicable in schools maintaining more than one department, or in which every division of the course is not represented; but in a majority of our country schools this will be impracticable, and in such cases it will be necessary to pursue a great many studies on alternate days. The only exception will be in favor of the third and fourth divisions of the third grade, whose different studies must be *daily*.

But even with alternate recitations it will sometimes be difficult to find time for all the exercises required by the course of studies. The following suggestions may therefore be of service to teachers in making out their daily programme. It must be premised that the following programme is made for a school in which every division of the course is represented; in other words, for a school in which the teacher has to teach at least eight classes. If the teacher has fewer classes, some of the recitations may be lengthened, or given more frequently. Teachers must bear in mind that for the primary classes, say the third and fourth divisions of the third grade, the recitations must be short and frequent; and even the time set apart for the pupils to study their lessons, or to do slate or blackboard work, must be short. Short and frequent recitations, short and frequently changed exercises on slate and blackboard, must be the rule; pupils must never be tired or wearied by a recitation or an exercise. But as pupils are older and more advanced, the recitation must in proportion be longer and less frequent; pupils must be more and more independent of the promptings, care, and supervision of the teacher.

To prepare a programme according to which the course of studies may be fully carried out in a school taught by one teacher, and maintained only six months—the minimum length of school terms assumed in preparing the course of studies—we must,

I. Divide the day into periods, during each of which instruction is given, and recitations are heard in some one study.

II. Whenever possible, the whole school, or as many divisions as possible, are formed into one class. In music, calisthenics, morals and manners, this will be the only practicable way of giving instruction. To illustrate:

Let every day one hour be devoted to teaching arithmetic. During this hour the *whole school* is to be instructed, is to recite and work, on slate and blackboard, in arithmetic. Let, for instance, this hour be from 9 to 10 A. M. At 9 A. M., after the usual opening exercises, every class in the school takes up its arithmetic lesson, and goes to work. The third and fourth divisions of the third grade should receive instruction, and recite every day. The best time for this will be found to be immediately after the opening exercises. After reciting, these grades are set to work, either on the slate or blackboard. After the lowest two divisions have recited, the class which is most in need of instruction is next called forward and taught. In this manner every day, besides the lowest two divisions, one or two of the higher divisions receive instruction, and in the course of a week every class in the school has received instruction. This instruction should be thorough enough to enable the class to advance a step each time, and to be fitted to profitably employ the rest of the week in grounding the instruction received, by working out the examples given in the arithmetic or furnished by the teacher by means of the arithmetical frame or the blackboard. It will be found that it is more profitable to leave a class to itself for several days, or even a week, in order that by self-efforts it may perfect itself in applying the principles and rules just learned, than to let it recite every day. If, for instance, a class has just learned short multiplication or division, and seemingly every one in the class understands the work, it is yet of the utmost importance, if for no other purpose than to ensure rapidity and quickness of work, that the class be thoroughly drilled; and most teachers will find that a single week will seldom be sufficient to do this. A single recitation may, therefore, only be needed to enable a class to be profitably employed for several days, or weeks even; and the teacher, by assigning a part or the whole of the class to the blackboard once or twice a week, and by looking over their slates, can easily watch the progress of the class, and discover when it needs some additional instruction or help from him.

Instead of having a daily recitation from every class in the school, which would consume at the very least two hours, and yet not give sufficient time to each recitation to allow of thorough instruction, by the above plan at least one hour a day is saved for other work; and as sometimes as much as forty minutes may be devoted to a single class, the instruction will be all the more thorough.

At 10 A. M., all arithmetic work is finished for that day. The next forty minutes, till recess, 10:40 A. M., are best spent in instructing the whole school in penmanship or drawing. For three days a week, penmanship should be taught during this time; for two days, drawing. At 10 A. M., the copy-books, or drawing-books, and slates are taken up, and each division set to work. The third and fourth divisions of the third grade should receive daily instruction. The only instruction in penmanship these two divisions receive is given while they are taught to print or write the words or paragraphs of their reading lessons; and so, while these divisions are instructed in writing they are also instructed in spelling; and thus, for each of these divisions, two recitations are disposed of at one and the same time. In fact, for the third division, three recitations are disposed of; for composition, which, for this division, consists principally in copying words and sentences printed or written on the blackboard by the teacher, can be taught in connection with writing.

After these two divisions of the third grade have recited and been set to work—which is done usually inside of twenty minutes—one or two of the other divisions can be instructed during the remaining time, and advanced sufficiently to need no recitation for several days. In other words, the same plan which has been suggested for teaching arithmetic will be, perhaps, the only practicable one for teaching penmanship and drawing.

From 10 to 10:40 A. M., the third and fourth divisions of the third grade have been instructed in spelling; the third division of the third grade in composition, and the whole school in penmanship or drawing.

From 11 to 12, first, object lessons for the lowest two divisions of the third grade, which, after recitation, are dismissed; then on Monday and Wednesday, geography for the four divisions of the first and second grades; on Tuesday and Thursday, history for the two divisions of the first grade, and geography for the first and second divisions of the third grade.

The following scheme will show the different recitations from 11 to 12 A. M.:

MONDAY AND WEDNESDAY.	TUESDAY AND THURSDAY.
Eighth Class, Object Lessons;	Eighth Class, Object Lessons;
Seventh Class, Object Lessons;	Seventh Class, Object Lessons;
Fourth Class, Geography;	Fifth Class, Geography;
Third Class, Geography;	Fourth Class, Geography;
Second Class, Geography;	First Class, History;
First Class, Geography.	Second Class, History.

From 1 to 2:40 P. M., recitations for the whole school in reading and spelling. That is to say, the seventh and eighth classes (the third and fourth divisions of the third grade) must recite every day in reading and spelling; the other classes read, say, on Monday and Wednesday, and spell on Tuesday and Thursday.

At 2:40, the third and fourth divisions of the third grade (which are presumed to comprise a majority of the pupils under eight years of age) are dismissed.

From 3 to 4, on Monday and Wednesday, composition and grammar for the first and second divisions of the first grade, and the four divisions of the second and third grades; on Tuesday and Thursday, object lessons, natural philosophy, and physiology, for the same divisions. Studies and instruction for which no provision is made in the above, such as music, morals and manners, calisthenics, etc., must be taught on Friday. This day should be used, also, for such general exercises as declamations, reviews, etc.

Spelling must be oral and written. The oral spelling may be advantageously connected with each reading lesson, if time permits; otherwise, if no other time can be found, a part of every Friday must be set apart for this exercise. In written spelling, at least twenty-five words should be dictated to each class. The most expeditious method of conducting a recitation in written spelling is the following: Every class takes up its slates; when every pupil is ready, dictate a word to

each class in succession, until twenty-five words, or the number selected, have been dictated to each class. This will take about ten minutes. Then let the pupils of each class interchange slates for mutual examination and correction, the use of the books from which the words were selected being allowed for this. For this, fifteen to twenty minutes are required; the upper classes will need less time, and may then be detailed to overlook the work of the lower classes. While the pupils are examining each other's slates, the teacher may either pass from pupil to pupil and examine the slates to see how the pupils do their work—which will be frequently necessary—or he may hear some other recitations. In fact, even if he does the former, he will have time in which to hear one or two recitations. But in dictating whole sentences or paragraphs, which should be a frequent exercise, the time will be fully occupied without any other recitations; and, therefore, none others have been assigned for the hour and forty minutes, from 1 to 2:40, though, if it should be necessary, as it may be in some schools, some of the recitations which are set for after 3 P. M., may be introduced from 1 to 2:40 P. M.; in which case the exercise in written spelling must be confined to the dictation of a number of words, the dictation of paragraphs being deferred to Friday. After the slates are examined by the pupils, they are repassed to their owners, the mistakes numbered, and credits given accordingly.

If written spelling is conducted in the above manner, word-analysis and defining need not occupy any separate time; for each class will have time enough, not only to write the word dictated, but also to analyze and define it.

We remind teachers once more that our remarks in regard to the programme are only *suggestive*. It is impossible to devise a programme adapted to the wants of every school-room. The administrative ability of the teacher—one of the first factors of success to the country teacher—will be shown by his ability to frame a programme. Without a good programme, the best teacher will fail, work he never so hard and faithfully. The full course of studies *must* be taught; and to help some of our teachers who may not be able to frame a programme embodying the full course—and there are many such; nay, there are teachers who have no programme at all, nor ever saw the necessity for one—we give these suggestions. Whoever can frame a better programme is free to do so.

We do not hold it necessary to give any additional instructions in regard to the recitations which have been assigned from 3 to 4 P. M. It must be remembered that only from the first division of the second grade upwards, grammar forms a study separate from composition.

In the morning, say at 10 A. M., and in the afternoon, say at 2 P. M., the whole school should go through some calisthenic exercises. The drilling and teaching of the movements must be left for Friday. Morals and manners form subjects less of set instruction than of constant practice and inculcating during every school hour. Should any definite instruction and recitation be necessary, time must be found for these on Friday. With music it is the same; though singing forms one of the best opening exercises, yet in very few schools can, on any other day than Friday, be instruction given in it. On Friday, however, at least one hour should be devoted to the *teaching* of music.

It is plain from the above, that Friday is reserved for those odds and ends of instruction, reviewing and examining for which no time can be found on the other days of the week.

GENERAL SUGGESTIONS FOR TEACHING THE COURSE OF STUDIES.

1.—USE OF TEXT-BOOKS.

The chief value of a text-book consists in the clear and precise statement of the aims and requirements in respect to the subject of instruction which it is presumed to present. The text-book should, first, distinctly indicate what is to be accomplished; secondly, indicate to the teacher the right way of handling the subjects of instruction. The text-book should, therefore, furnish the pupil with suitable topics, properly arranged and clothed in appropriate language, and furnish the teacher with "new methods of illustration, and new paths through which the pupil may be led to the direct comprehension of the facts learned, to the fullest apprehension of their value, and to the best understanding of their relations to other facts previously learned."

Unfortunately, book-makers and publishers have seen fit to lumber text-books with a great mass of useless details, in some instances completely smothering if not excluding what alone is of real importance to the pupil. The first care of a teacher must, therefore, be, not to teach the contents of a text-book the best way he can, but to winnow the chaff from the wheat. To do this his knowledge of the subject must be full and comprehensive, and far more so than can ever be required of pupils. This will give him such a familiarity with the topics to be studied by the pupils that the text-book is to him a book of reference only, to which he is never confined, either in instructing or during recitation. Hence in recitations the text-book must be laid aside by the teacher, except in the case of reading, grammatical analyses, and spelling. In every other exercise the text-book will be a hindrance rather than a help.

The teacher will now be prepared to assign lessons and recitations of the proper kind and length; and the pupils will soon find that the teacher's work is to "*teach and work with them*," instead of the automatic work of merely giving out lessons which are gauged by the number of paragraphs or pages the pupil is assumed to be able to ponder over in a definite time, and of hearing recitations which are too frequently determined by the questions at the end of the lesson, or the bottom of the page. During recitations the pupil's desk is the proper place for the pupil's text-book. In all recitations, except as stated above, text-books should be laid aside by teacher and pupil alike. We offer the following, taken from the *Chicago Course of Instruction*, as additional suggestions, which will be of value to teachers:

"Before the recitation, the teacher will have arranged the divisions of the subject treated of in the lesson assigned, and he will then hold his pupils to the order he shall have determined to be the best, requiring not always the identical language of the author, but something equally exact and comprehensive. In mathematical studies, the recitation should consist largely of exercises illustrative of the principles of the text-book, involving the same process, but varied in figures and in verbal statement from the exercises given by the author.

"The teacher's aim will be to test the pupil's knowledge of the subject studied, to correct any misapprehensions he may have fallen into while studying, to ascertain what difficulties have been encountered,

and to guide the pupil to the means by use of which he may gain complete mastery over his difficulties. The recitation may be so conducted as to give the teacher information as to the accuracy of the pupil's knowledge, or so as to give the pupil information upon the best method of study. Both are important, and the occasion for either method must be determined as the recitation progresses. These things admitted, it follows as a matter of course that the recitation hour is not a lecture hour, during which the pupil is to receive, passively, the instructions of the teacher; nor is it the hour devoted to the solution of all difficult problems deferred till this time by indolent students; nor yet is it the time for a parrot-like repetition of what the author says. In almost every recitation the pupil should be required to trace the relation of some new fact to previously learned principles. The surest course out of any difficulty is to lead the pupil back to ground with which he is familiar, and thus by skillful questioning to let the light in upon his mind.

"Recitations should not be continued after the teacher has failed to fix or to hold the attention of the majority of his class.

"Questions should be so put as to require thought upon the part of all the class, and not alone upon the part of him whose turn has come to answer. As far as possible, all routine questioning should be discarded, and every pupil be made to feel that he may be called upon to answer any and every question asked."

How to use a text-book, and when and in what particulars to dispense with it, will be more fully explained under the different studies and in the instructions for the different divisions.

2.—ORAL INSTRUCTION.

In acting upon the suggestions given in the foregoing section, considerable oral instruction will be necessary. In fact, for the Third Grade, the instruction should be all oral. In the other grades, also, topics are assigned for which no text-books are provided. In the studies for which text-books are provided, oral instruction must almost constantly be employed to elucidate, amplify, and supplement the text-book. For suggestions we can do no better than copy the following excellent remarks from the *Chicago Manual*, already quoted above:

"Properly understood and pursued, it [oral instruction] will prove of great value, both by reason of the actual knowledge gained, and more especially of the desire awakened for farther and more exhaustive study. The habits of observation it demands, and the interest it engenders, are of incalculable value to the student. The incidental advantage of leaving the pupil to the expression of his own thoughts and ideas is by no means to be despised. These benefits are proportioned to the general intelligence and tact of the teacher, and the reflex influence of 'The Oral Course' upon the faithful teacher will appear in increased teaching power. New sources of illustration are opened, and the ability to employ them is largely augmented.

"Nearly every recitation furnishes occasion for more or less incidental instruction, but the teacher who embraces every opportunity to switch off upon side issues may be sure that his time will be largely wasted. The thoughtful instructor will find some occasions that he will not dare neglect. These generally occur in the line of a well-arranged

oral course prepared primarily to suit the natural order of development of the child's mind, and secondarily to fit the text-book studies.

"Very many of the topics in the Oral Course can be treated most successfully as object lessons. The presence of the object gives life to the study. But mere gossip about the object is of no avail. There must be *systematic* study. *First:* What do our senses tell us of the object presented as to color, form, taste, smell, etc.? *Second:* What can we recall of the object when no longer seen, heard, tasted, smelled, or felt? *Third:* What are its points of resemblance or of contrast when compared with other objects with which we are familiar? *Fourth:* To which of the three kingdoms of nature does it belong, and what shall be its general classification? *Fifth:* What shall we infer as to its uses and its practical value? The present knowledge of the child will determine how much time shall be spent upon each of the above divisions, but their order may not safely be changed, nor should the attention of the child be diverted from any one until some definite knowledge is gained.

"Teachers should make thorough preparation for these exercises, and be sure that their instructions are simple, concise, and accurate. They should never tell a child what he may be made to tell them, and should never give any information without calling for it again.

"While a definite time should be assigned to this exercise, and, as a general rule, no deviation be allowed from the programme, still occasionally opportunities will arise when the object lesson may be more impressive than at any other time, and advantage should be taken of such favorable opportunities, though it may call up objects out of their regular order.

"Some of the facts of meteorology may be most vividly impressed upon the mind during the passage of a severe storm. The parade of a menagerie may furnish excellent opportunities for lessons upon the camel or elephant. The tact of the successful teacher will turn many such occasions to good account.

"That instruction of the character sketched above may not be entirely neglected, the topics assigned to each grade should be made a part of the examination for promotion from grade to grade, and at least of equal value with any other portion of the work of the grade. In estimating results of this examination, the expression of the pupils' own observations and thoughts upon the several topics should be counted as of more worth than any repeated words of others, which he may have been required to commit to memory. In other words, the examiner should seek to learn how much the pupil has thought, rather than how much he has absorbed.

"Nor is it desirable for the teacher to undertake too many subjects. One thoroughly understood, as far as the capacity of the pupil will permit, is better than many superficially treated. If all the subjects given as examples can be thus thoroughly understood, it is well, but if time will not permit the mastery of all, it is better that selections be made, and that the topics selected be carefully studied."

Below we give an outline of lessons on *Sense-Perception*, or *Object Teaching*, published originally in the CALIFORNIA TEACHER.

3.—MENTAL DISCIPLINE.

The ultimate object of all education must be mental discipline, and not the mere acquisition of knowledge. The acquisition of knowledge is simply the means by which the mental faculties and capacities are developed. The knowledge gained is at the best but limited, and sometimes only ephemeral, and of little if any value to the pupil in after-life. But the mental discipline is all important, of lasting value, and the first condition to the pupil's success in life.

Mental discipline depends upon mental labor. This labor may be of two very different kinds; first, the pupil may be simply required to understand or seem to understand the statement of the text book, and of the teacher in oral instruction; or secondly, the pupil may be required to rediscover for himself the knowledge of the text-book. The former is unfortunately most usually if not almost universally the only labor imposed upon the pupil; and yet the latter is the only labor which can give that mental discipline which will truly educate the child.

We need to give no instructions in regard to the method to be pursued in order to so teach and drill the pupil that he is able to repeat, *verbatim et literatim*, the statements of the text-books, and of the teacher in oral instruction. Every dull, hard pedant has such methods at his finger's end.

But we have a few earnest words for those who are striving to make the pupil really understand the text-book. The trouble with them is, that they religiously hold that the knowledge supplied by the text-book must be taught and learned by the pupil in its sequence and entirety. Sometimes even the methods of instruction prescribed by the book are held to be obligatory upon teachers; though, fortunately, a little more latitudinarianism in this respect, is creeping into the profession. If we now remember that the contents of a text-book are usually arranged, not according to the order of development, but according to the present system of the science, a part of which the book presents, it will be seen that a book which may be adapted for maturer minds is yet totally unfit for children. To illustrate:

In arithmetic, certain methods of analysis are employed in the stating and solving of problems. The value of these methods has been fully demonstrated in the case of the higher grades of scholars. Hence teachers and book-makers have concluded that a strict adherence to these methods from the very beginning, would be the shortest and surest road to satisfactory results in teaching arithmetic. But further yet, as the elements of every study should certainly stand at the entrance to that study, the commencement of every arithmetic bristles with definitions of "arithmetic," "quantity," "numbers," "axioms," etc. All this is perhaps necessary to a full and thorough presentation of the subject as a science, but it is not only not necessary but detrimental to the education of the child. A child *cannot* be taught the science of number; it can deal with number only as a property of bodies; and as definitions are abstractions, generalizations, all definitions as introductory to a study, are worse than meaningless to a child—they are actual hindrances to its understanding of a subject. This is true in arithmetic, in geography, in grammar; in short, in every study in which the introductory elements are expressed in definitions. In arithmetic, again, the child's ideas of number are, primarily, dependent upon the actual presentation of objects; and the four fundamental operations are clear

enough to a child if taught by the help of objects, and without any inflexible method of analysis. And yet such inflexible method of analysis is presented even in the Primary Arithmetics as *the* method by which to insure correct arithmetical reasoning, and many teachers, unfortunately, seem to be impressed with the importance and feasibility of such method, when they find that after more or less of constant drill the pupils are at last able to solve every problem according to the prescribed analysis. And yet the whole process may involve no more real intellectual labor than is required of a trained animal in performing the task its master has taught it. We too frequently forget that explanations in set phrases may depend upon the cultivation, not of the understanding, but of the memory solely. Then, again, children may even talk about things correctly enough, and yet attach no idea to their words.

What we have said of arithmetic is true of grammar, geography, and of it especially, and of other studies. The true method of instruction is to lead the pupil from the known to the unknown; from the concrete to the abstract, and by steps which the pupil must take himself. It is not sufficient that he understands and can repeat the steps indicated in the text-book to arrive at a definite result. On the contrary, the pupil must discover these steps without reference to the text-book or aid of teacher, the teacher no more than guiding him into the correct course.

The teacher must then have a definite end in view in every lesson he assigns from a text-book; he must thoroughly understand the connection between it and the preceding, and also the succeeding lesson; and he must well weigh the steps the pupil must take in order to obtain the full mental discipline the mastering of the lesson can give him. The capabilities of the pupil, the difficulties of the lessons must be studied, and determine the measure of help the pupil may require. If solely by the constant and watchful assistance of the teacher, a pupil should at last really understand a lesson, the principal mental discipline, that of gaining strength by overcoming difficulties, has been sacrificed, and the child's mind weakened instead of developed. On the other hand, all assistance cannot be dispensed with; the problem is to find how much assistance is absolutely required. No inflexible rule can be devised; the individual differences of pupils must be carefully considered. This is, perhaps, the most difficult portion of the teacher's work. The thoroughness of a teacher's culture and capacity will infallibly be tested here. In conclusion, we add some remarks from Mr. Quick's *Essays on Educational Reformers* (Chap. IX, Herbert Spencer, page —):

"1. We should proceed from the simple to the complex, both in our choice of subjects and in the way in which each subject is taught. We should begin with but few subjects at once, and, successively adding to these, should finally carry on all subjects abreast.

"Each larger concept is made by a combination of smaller ones, and presupposes them. If this order is not attended to in communicating knowledge, the pupil can learn nothing but words, and will speedily sink into apathy and disgust.

"That we must proceed from the known to the unknown is something more than a corollary to the above; because not only are new concepts formed by the combination of old, but the mind has a liking for what it knows, and this liking extends itself to all that can be connected with its object. The principle of using the known in teaching

the unknown is so simple, that all teachers who really endeavor to make anything understood, naturally adopt it. The traveler who is describing what he has seen, and what we have not seen, tells us that it is in one particular like this object, and in another like that object, with which we are already familiar. We combine these different concepts we possess, and so get some notion of things about which we were previously ignorant. What is required in our teaching is that the use of the known should be employed more systematically. Most teachers think of boys who have no school learning as entirely ignorant. The least reflection shows, however, that they know already much more than schools can ever teach them. A sarcastic examiner is said to have handed a small piece of paper to a student, and told him to write *all he knew* on it. Perhaps many boys would have no difficulty in stating the sum of their school learning within very narrow limits, but with other knowledge a child of five years old, could he write, might soon fill a volume. Our aim should be to connect the knowledge boys bring with them to the school-room with that which they are to acquire there. I suppose all will allow, whether they think it a matter of regret or otherwise, that hardly anything of the kind has hitherto been attempted. Against this state of things I cannot refrain from borrowing Mr. Spencer's eloquent protest: 'Not recognizing the truth that the function of books is supplementary, that they form an indirect means to knowledge when direct means fail, a means of seeing through other men what you cannot see for yourself, teachers are eager to give second-hand facts in place of first-hand facts. Not perceiving the enormous value of that spontaneous education which goes on in early years, not perceiving that a child's restless observation, instead of being ignored or checked, should be diligently ministered to and made as accurate and complete as possible, they insist on occupying its eyes and thoughts with things that are, for the time being, incomprehensible and repugnant. Possessed by a superstition which worships the symbols of knowledge instead of the knowledge itself, they do not see that only when his acquaintance with the objects and processes of the household, the street, and the fields is becoming tolerably exhaustive, only then should a child be introduced to the new sources of information which books supply, and this not only because immediate cognition is of far greater value than mediate cognition, but also because the words contained in books can be rightly interpreted into ideas only in proportion to the antecedent experience of things.' After remarking on the wrong order in which subjects are taught, he continues: 'What with perceptions unnaturally dulled by early thwartings and a coerced attention to books, what with the mental confusion produced by teaching subjects before they can be understood, and in each of them giving generalizations before the facts of which they are the generalizations, what with making the pupil a mere passive recipient of others' ideas, and not in the least leading him to be an active inquirer or self-instructor, and what with taxing the faculties to excess, there are very few minds that become as efficient as they might be.' While agreeing heartily in the spirit of this protest, I doubt whether we should wait till the child's acquaintance with the objects and processes of the household, the street, and the fields is becoming tolerably exhaustive before we give him instruction from books. The point of time which Mr. Spencer indicates is, at all events, rather hard to fix, and I should wish to connect book-learning as soon as possible with the learning that is being acquired in other ways. Thus might both the books and the acts and

objects of daily life win an additional interest. If, *e. g.*, the first reading books were about the animals, and later on about the trees and flowers which the children constantly meet with, and their attention were kept up by large colored pictures, to which the text might refer, the children would soon find both pleasure and advantage in reading, and they would look at the animals and trees with a keener interest from the additional knowledge of them they had derived from books. This is, of course, only one small application of a very influential principle.

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"3. 'Our lessons ought to start from the concrete, and end in the abstract.' What Mr. Spencer says under this head well deserves the attention of all teachers. 'General formulas which men have devised to express groups of details, and which have severally simplified their conceptions by uniting many facts into one fact, they have supposed must simplify the conceptions of a child also. They have forgotten that a generalization is simple only in comparison with the whole mass of particular truths it comprehends; that it is more complex than any one of these truths taken simply; that only, after many of these single truths have been acquired, does the generalization ease the memory, and help the reason; and that, to a mind not possessing these single truths, it is necessarily a mystery. Thus, confounding two kinds of simplification, teachers have constantly erred by setting out with 'first principles,' a proceeding essentially, though not apparently, at variance with the primary rule [of proceeding from the simple to the complex], which implies that the mind should be introduced to principles through the medium of examples, and so should be led from the particular to the general, from the concrete to the abstract.' In conformity with this principle, Pestalozzi made the actual counting of things precede the teaching of abstract rules in arithmetic. Basedow introduced weights and measures into the school, and Mr. Spencer describes some exercises in cutting out geometrical figures in cardboard as a preparation for geometry. The difficulty about such instruction is that it requires apparatus, and apparatus is apt to get lost or out of order. But, if apparatus is good for anything at all, it is worth a little trouble. There is a tendency in the minds of many teachers to depreciate 'mechanical appliances.' Even a decent blackboard is not always to be found in our higher schools. But, though such appliances will not enable a bad master to teach well, nevertheless, other things being equal, the master will teach better with them than without them. There is little credit due to him for managing to dispense with apparatus. An author might as well pride himself on being saving in pens and paper.

"4. 'The genesis of knowledge in the individual must follow the same course as the genesis of knowledge in the race.' This is a thesis on which I have no opinion to offer. It was, I believe, first maintained by Pestalozzi.

"5. From the above principle Mr. Spencer infers that every study should have a purely experimental introduction, thus proceeding through an empirical stage to a rational.

"6. A second conclusion which Mr. Spencer draws is that, in education the process of self-development should be encouraged to the utmost. Children should be led to make their own investigations, and to draw their own inferences. They should be told as little as possible, and induced to discover as much as possible. I quite agree with Mr. Spencer, that this principle cannot be too strenuously insisted on, though it obviously

demands a higher amount of intelligence in the teacher. But if education is to be a training of the faculties, if it is to prepare the pupil to teach himself, something more is needed than simply to pour in knowledge and make the pupil reproduce it. The receptive and reproductive faculties form but a small portion of a child's powers, and yet the only portion which many schoolmasters seek to cultivate. It is, indeed, not easy to get beyond this point; but the impediment is in us, not in the children. 'Who can watch,' asks Mr. Spencer, 'the ceaseless observation, and inquiry, and inference, going on in a child's mind, or listen to its acute remarks in matters within the range of its faculties, without perceiving that these powers it manifests, if brought to bear systematically upon studies *within the same range*, would readily master them without help? This need for perpetual telling, results from our stupidity, not from the child's. We drag it away from the facts in which it is interested, and which it is actively assimilating of itself. We put before it facts far too complex for it to understand, and therefore distasteful to it. Finding that it will not voluntarily acquire these facts, we thrust them into its mind by force of threats and punishment. By thus denying the knowledge it craves, and cramming it with knowledge it cannot digest, we produce a morbid state of its faculties, and a constant disgust for knowledge in general. And when, as a result, partly of the stolid indolence we have brought on, and partly of still continued unfitness in its studies, the child can understand nothing without explanation, and becomes a mere passive recipient of our instruction, we infer that education must necessarily be carried on thus. Having by our method induced helplessness, we make the helplessness a reason for our method.' It is, of course, much easier to point out defects than to remedy them; but every one who has observed the usual indifference of school boys to their work, and the waste of time consequent on their inattention, or only half-hearted attention to the matter before them, and then thinks of the eagerness with which the same boys throw themselves into the pursuits of their play hours, will feel a desire to get at the cause of this difference; and, perhaps, it may seem to him partly accounted for by the fact that their school work makes a monotonous demand on a single faculty—the memory.

"7. This brings me to the last of Mr. Spencer's principles of intellectual education. Instruction must excite the interest of the pupils, and therefore be pleasurable to them. 'Nature has made the healthful exercise of our faculties both of mind and body pleasurable. It is true that some of the highest mental powers, as yet but little developed in the race, and congenitally possessed in any considerable degree only by the most advanced, are indisposed to the amount of exertion required of them. But these, in virtue of their very complexity, will in a normal course of culture come last into exercise, and will, therefore, have no demands made on them until the pupil has arrived at an age when ulterior motives can be brought into play, and an indirect pleasure made to counterbalance a direct displeasure. With all faculties lower than these, however, the immediate gratification consequent on activity, is the normal stimulus, and under good management the only needful stimulus. When we have to fall back upon some other, we must take the fact as evidence that we are on the wrong track. Experience is daily showing with greater clearness that there is always a method to be found productive of interest—even of delight—and it ever turns out that this is the method proved by all other tests to be the right one.'

"As far as I have had the means of judging, I have found that the

majority of teachers reject this principle. If you ask them why, most of them will tell you that it is impossible to make school-work interesting to children. A large number also hold that it is not desirable. Let us consider these two points separately.

"Of course, if it is not possible to get children to take interest in anything they could be taught in school, there is an end of the matter. But no one really goes as far as this. Every teacher finds that some of the things boys are taught they like better than others, and perhaps that one boy takes to one subject and another to another, and he also finds, both of classes and individuals, that they always get on best with what they like best. The utmost that can be maintained is, then, that some subjects which must be taught will not interest the majority of the learners. And if it be once admitted that it is desirable to make learning pleasant and interesting to our pupils, this principle will influence us to some extent in the subjects we select for teaching, and still more in the methods by which we endeavor to teach them. I say we shall be guided *to some extent* in the selection of subjects. There are theorists who assert that nature gives to young minds a craving for their proper aliment, so that they should be taught only what they show an inclination for. But surely our natural inclinations in this matter, as in others, are neither on the one hand to be ignored, nor on the other to be uncontrolled by such motives as our reason dictates to us. We at length perceive this in the physical nurture of our children. Locke directs that children are to have very little sugar or salt. 'Sweetmeats of all kinds are to be avoided,' says he, 'which, whether they do more harm to the maker or eater is not easy to tell.' (Ed. § 20.) Now, however, doctors have found out that young people's tastes for sweets should in moderation be gratified; that they require sugar as much as they require any other kind of nourishment. But no one would think of feeding his children entirely on sweetmeats, or even of letting them have an unlimited supply of plum-puddings and hardbake. If we follow out this analogy in nourishing the mind, we shall to some extent gratify a child's taste for stories, whilst we also provide a large amount of more solid fare. But although we should certainly not ignore our children's likes and dislikes in learning, or in anything else, it is easy to attach too much importance to them. Dislike very often proceeds from mere want of insight into the subject. When a boy has 'done' the First Book of Euclid without knowing how to judge of the size of an angle, or the Second Book without forming any conception of a rectangle, no one can be surprised at his not liking Euclid. And then the failure which is really due to bad teaching is attributed by the master to the stupidity of his pupil, and by the pupil to the dullness of the subject. If masters really desired to make learning a pleasure to their pupils, I think that they would find that much might be done to effect this without any alteration in the subject taught.

"But the present dullness of school-work is not without its defenders. They insist on the importance of breaking in the mind to hard work. This can only be done, they say, by tasks which are repulsive to it. The school boy does not like, and ought not to like, learning Latin grammar any more than the colt should find pleasure in running round in a circle; the very fact that these things are not pleasant makes them beneficial. Perhaps a certain amount of such training may train *down* the mind and qualify it for some drudgery from which it might otherwise revolt; but if this result is attained, it is attained at the sacrifice of the intellectual activity which is necessary for any higher function.

As Carlyle says, when speaking of routine work generally, you want nothing but a sorry nag to draw your sand cart; your high spirited Arab will be dangerous in such a capacity. But who would advocate for all colts a training which should render them fit for nothing but such humble toil? I have spoken elsewhere on this subject, and here I will merely express my strong conviction that boys' minds are frequently dwarfed, and their intellectual pursuits blighted, by the practice of employing the first years of their school life in learning by heart things which it is quite impossible for them to understand or care for. Teachers set out by assuming that little boys cannot understand anything, and that all we can do with them is to keep them quiet and cram them with forms which will come in useful at a later age. When the boys have been taught on this system for two or three years, their teacher complains that they are stupid and inattentive, and that so long as they can say a thing by heart, they never trouble themselves to understand it. In other words, the teacher grumbles at them for doing precisely what they have been taught to do, for repeating words without any thought of their meaning.

"In this very important matter, I am fully alive to the difference between theory and practice. It is so easy to recommend that boys should be got to understand and take an interest in their work; so difficult to carry out the recommendation! Grown people can hardly conceive that words which have in their minds been associated with familiar ideas from time immemorial, are mere sounds in the mouths of their pupils. The teacher thinks he is beginning at the beginning if he says that a transitive verb must govern an accusative, or that all the angles of a square are right angles. He gives his pupils credit for innate ideas up to this point, at all events; and advancing on this supposition, he finds that he can get nothing out of them but memory-work; so he insists on this, that his time and theirs may not seem to be wholly wasted. The great difficulty of teaching well, however, is after all but a poor excuse for contentedly teaching badly; and it would be a great step in advance if teachers in general were as dissatisfied with themselves as they are usually with their pupils.

"Mr. Spencer and Professor Tyndall appeal to the results of experience as justifying a more rational method of teaching. Speaking of geometrical deductions, Mr. Spencer says: 'It has repeatedly occurred that those who have been stupefied by the ordinary school drill—by its abstract formulas, its wearisome tasks, its cramming—have suddenly had their intellects roused by thus ceasing to make them passive recipients, and inducing them to become active discoverers. The discouragement caused by bad teaching having been diminished by a little sympathy, and sufficient of perseverance excited to achieve a first success, there arises a revolution of feeling affecting the whole nature. They no longer find themselves incompetent; they, too, can do something. And gradually, as success follows success, the incubus of despair disappears, and they attack the difficulties of their other studies with a courage insuring conquest.'"

The following will indicate the most efficient means of securing the greatest amount of mental discipline in oral instruction. The means to be used in text-book instruction and recitations, will be indicated under the several branches of study:

"1. *The teacher, in all the instruction which he gives, must study a strict*

order of thought, and an easy and simple manner of presenting his thought. Every lesson upon a given subject must be a discourse complete in itself, whose separate groups of thoughts the teacher has so to divide, give prominence to, and distinctly mark, that they are clearly distinguished by the scholar's perception also. The more smooth and measured the recital of the teacher, or his descriptions of subjects belonging to the domain of natural history, or other subjects, the sharper he, on the one hand, draws the line between the separate thoughts, while on the other, he makes his pupils also sensible and conscious of the relation of the separate thoughts to each other, so much the greater will become the capability and inclination of his pupils to direct their attention to the unity of the discourse, and to arrange, in their proper order, groups of thoughts, according to their divisions and subdivisions; in a word, to understand the discourse.

"2. *In all recitations the pupils must be accustomed to give their answers in the form of complete sentences, and, by degrees, to express themselves more and more fully in regard to what they have heard or seen.* Such a demand upon the scholar forces him at the same time to follow the teacher with the strictest attention. Thus it is judicious, perseveringly to maintain with the pupil a loud, distinct, and smooth tone of speech. The pupil must also learn to take time for his own utterance, to observe his thoughts, their order, and connection."—*Fundamental Principles of Teaching Language, California Teacher, June*, 1873.

4.—READING.

In reading, the Fourth and Fifth Readers are to be completed each in two years, instead of one, as formerly. The Sixth Reader has been discontinued, except *in the advanced grade.*

This change was imperatively demanded. Both the Fourth and the Fifth Readers are so voluminous that no child could master either of them in a ten months term of school.

The aim in teaching reading is to make the language of literature intelligible to the pupil. This includes the intelligent comprehension, first, *of the thoughts expressed by the author*, and, secondly, *of the manner in which these thoughts are expressed.* The latter is possible only when the former has been secured. Our first task is, then, to guide the learner to the intelligent comprehension of the thoughts expressed by the author. Let us now examine the composition of a complete reading lesson.

1. "One main thought underlies as groundwork of the separate thoughts, and these latter group themselves around the former, and, in subordination to it, flow together in unity. The main thought is the product, the result, the total abstract of the thoughts belonging to it.

2. "These separate thoughts, whose product is the main thought, again divide themselves into larger or smaller groups of thought, which groups consist of a number of opinions or propositions, ever subordinate, however, to the piece taken as a whole.

3. "Finally, we come to what is called in the study of language a sentence; the sentence, again, is a unit, composed of separate parts. Further, around the principal sentence we find dependent sentences

grouped, and around the subject and predicate of a simple sentence the other members of the sentence.

4. "Every part of a sentence consists of words which have for their foundation a certain sense or meaning, idea or conception."

The first requisite in reading is, then, that the pupil possesses the mental capacity to understand the piece as a whole, and to be able to grasp and hold fast to the main thought.

Secondly, he must be able to distinguish for himself the principal and subordinate, or major and minor parts of the piece, to be conscious of them, and also of their relation to the piece as a whole.

Thirdly, he must be able to feel mentally conscious of the single parts of a sentence, and of their relations to each other, and to the whole sentence.

The fourth and last requirement is that the pupil knows or is able to find out the sense or meaning of the words composing every part of a sentence, and to unite them into the idea, or conception, or thought which that part of the sentence is intended to express.

In teaching reading we must follow a reverse order from the above; and the fourth and last requirement becomes the first. The following instructions will indicate to the teacher the manner of securing, successively, the above mentioned requisites.

1. *The teacher must read to his pupils with clear, distinct accentuation, suited to the meaning, every piece selected as a reading lesson.* The purpose of this reading by the teacher is to furnish the pupils with a necessary model, and, at the same time, to make it easier for them to understand the piece; and it is principally by the manner of accentuation—something which cannot be expected from children—that the reference and relation of the thoughts to each other is made intelligible and comprehensible.

2. From the very beginning pupils must be required to form the habit of loud, distinct reading, in which the punctuation marks, or dividing points, are rigorously observed. Every sound, every syllable, every word, every phrase, every simple sentence in a compound sentence, and also the latter itself as a part of the whole, must be brought out, well cut, and sharply defined by the voice; thereby the scholar finally attains also to the conscious perception of every separate thought contained in the piece read, together with the images and ideas thereof. It becomes continually more and more possible for him to gain an insight into the organism of language in its unity.

3. The reading lesson is to be read by teacher and by pupils in conformity with the foregoing requirements, and, when too long or when the ability of the pupils is insufficient, then by questioning let it be drawn out by sections or paragraphs from the pupils themselves; or, where possible, let them repeat it by sections.

4. Unintelligible or obscure expressions which, in reading, questioning, and recitation, have been brought to the notice of the teacher, are to be explained to the pupils and erroneous ideas corrected.

5. The reading lesson is to be considered in its separate sections—that is, the principal or larger groups are to be noticed.

6. The different thoughts contained in the separate sections or larger groups of thoughts, are to be so brought out that the learner becomes aware of them. By mere reading, these thoughts pass in too quick succession through the child's mind, so that the child often does not know what he has read.

7. The particular manner of utterance or expression of these separate thoughts is to be remarked upon; also the reference or relation of these thoughts to each other. Here the attention is to be fixed upon the separate sentences of the reading lesson, and the pupils must learn to perceive the signification of the phrases and separate parts of the sentence, their relation to the complete sentence, and the ideas and forms of words, etc., thus introduced.

We append some more definite instructions, again taken from the *Chicago Revised Course of Instruction:*

"To test the accuracy of the child's knowledge of what he reads, he should be encouraged to alter sentences, substituting for some selected words, words of his own choosing, that shall change the form but not the meaning of the passage. This exercise may embrace at first but a single word in each sentence, and then may be extended as the capacity of the pupil may seem to warrant, until nearly or quite all the words are changed. In the more advanced classes, poetical selections may be changed into prose. While the definitions given by the author should not be neglected, the child should be encouraged, so far as possible, to give definitions of his own; and should be permitted, as indicated above, to put his definition into the place of the words defined, and then to read the sentence he has changed. This test may be still further extended by requiring the pupil to embody the selected words in sentences of his own construction. If the teacher finds difficulty in securing proper expression in any particular way, the remedy may be found in asking a question, the proper answer to which would be the difficult passage, and in requiring the pupil to give the passage as an answer to the question asked.

"The advantages of concert reading will not pay for a single bad habit formed by its careless use. The attention of the class may be kept by other methods, one of which is of importance in the recitations as well—that is, calling your scholars out of their regular order of standing or sitting; and, if need be, calling upon the same person two or three times, until the impression that he will be called on but once is entirely dissipated. Answers to general questions connected with reading lessons may be given in concert. The enunciation of elemental sounds may also be given in concert. Poetical selections which are already measured, may also be given in concert, with less difficulty and with less danger than prose. While a class is engaged in reading, the undivided attention of the teacher should be given to it. If the attention of the teacher be called away necessarily, the exercise should be suspended.

"Children should be encouraged to criticise each other fairly and justly. Raising the hand during the progress of the reading should not be allowed; but, at its close, those who have noticed errors should have an opportunity of correcting them, provided always that the critic can illustrate his own criticism. This should be occasionally tested.

"An excellent teacher gives as the result of her experience, this important caution: 'Children must be taught to open their mouths before they can become good readers.' The importance and value of this suggestion are fully confirmed by the experience of all good teachers.

"Frequent exercises, varied according to the advancement of pupils, in the utterance of elementary sounds, single and combined, should be most faithfully attended to before each exercise in reading. * * * While good articulation is not the *end* of reading, it is an essential *means*,

and one without which the true end—expression of thought—can never be attained.

"There is no fault more common in reading than that of stumbling, hesitating, catching, and repeating. It is but one fault, and teachers should use every effort to break it up. The moment the child shows the first symptom, his case should be carefully but immediately considered, and strict attention at once given to its cure. It sometimes arises from the child's vocal organs getting the start of his thoughts, and should be cured by a little hard study, until the pupil becomes familiar enough with the thought to have his mind keep ahead of his voice. It sometimes arises from pure carelessness, and its cure needs no mention. It often arises from the use of books in advance of the child's capacity, so that reading becomes mere utterance, without so much as a thought creeping in even behind a word uttered. The case suggests its own remedy. It sometimes arises from indulgence in a similar habit in all other recitations. Whatever its cause, its cure must be certain, or no progress is made, but on the other hand, constant retrogression.

"Improper breathing has much to do with poor reading, and a variety of breatning exercises should be practiced in connection with each lesson. Among those most beneficial may be mentioned: slow and silent inhalation and exhalation; quick inhalation and very slow and silent exhalation; quick inhalation and explosive exhalation; slow and silent inhalation and explosive exhalation; quick inhalation and slow exhalation, with the utterance of some simple vowel sound; slow inhalation and explosive exhalation, with the utterance of some simple vowel sound, etc. All these exercises should be practiced by the class, standing squarely and fairly upon their feet, with shoulders thrown back and head in its natural position."

The several Readers give abundant phonic and elocutionary rules and exercises. If time permits, the exercises given in Murdock and Russell's *Vocal Culture* may be taken up. The book should be in every school library.

Special attention should be paid to the reading of poetry. It is just as easy to train children from the very commencement to read poetry according to the rhythm, poetical pauses, etc., as to permit them to acquire the so common sing-song style of reading poetry. In the Fourth Reader all needed instructions are given. Of course, in the divisions of the third grade, the pupils are not to scan the poetry before reading it. The teacher simply insists that the pupils read as he reads—emphasizing syllables, making pauses, etc., as they hear the teacher do.

5.—SPELLING.

In spelling, the spelling books have been discontinued, and the minimum requirement is now that the child be taught to spell orally, or write at dictation, any word or paragraph of the reading lessons, and the technical words used in the several branches taught. The reason for this change from spelling-book lesson to the spelling of the words with which the child becomes practically acquainted in reading, writing, and studying, is obvious. The ultimate object of all spelling exercises is to train pupils to write words with the proper letters, according to common usage. As is well known, the words employed by a writer are dependent upon the nature and extent of the writer's mental culture. The mental culture of a person will, therefore, determine the words he uses

in writing, and his art of spelling should be co-extensive with his vocabulary. The usual method has been to present to the learner a vocabulary of the words which occur, or may occur, in daily use, in conversation, in newspapers, and in current literature, including popular science. This vocabulary is arranged, not according to the learner's mental development, as represented by the words he will most naturally employ at every stage, but according to the length of the words, their derivation, and classification. Naturally enough, therefore, the name of a thing is frequently presented long before the idea of the thing is presented to the learner. The spelling-book, or speller, as it is usually called, aims to anticipate the words, whose meaning the learner may learn in his school-course, or in after-life; and it is assumed that if the learner can store away in his mind the spelling of these words, he is fully equipped in one of the first requisites of composition—good spelling. Unfortunately, this is contrary to all mental laws, and hence it obstructs all mental development, and is subvertive of the very object aimed at. Spelling isolated words, as they are usually arranged and grouped in spelling-books, is a mere waste of time. It has a tendency to accustom pupils to use words, or read words, without associating a meaning with them; for isolated words awaken and produce no ideas, and because they do not, pupils have no use for them, are not interested in them. Being mere empty meaningless signs, they are speedily eliminated, rejected, and forgotten. "In Scotland," says Horace Mann, "the spelling-book is call the 'spell-book,' and we ought to adopt that appellation here, for, as it is often used with us, it does cast a spell over the faculties of children, which generally they do not break for years, and oftentimes, we believe, never. If any two things on earth should be put together, and kept together, one would suppose that it should be the idea of a thing and the name of a thing. The spelling-book, however, is a most artful and elaborate contrivance by which words are separated from their meanings, so that the words can be transferred into the mind of the pupil, without permitting any glimmer of their meaning to accompany them. A spelling-book is a collection of things without the thing signified—of words without sense—a dictionary without definitions. It is a place where words are shut up and impounded so that their signification cannot get at them; yet formerly it was the almost universal practice—and we fear it is now nearly so—to keep children two or three years in the spelling-book, where the mind's eye is averted from the object, qualities, and relation of things, and fastened upon a few words, of themselves wholly uninteresting."

Various have been the methods to avoid the evils attendant upon the use of Spellers. Pupils have been required to give the definitions of the words they were required to spell. This the pupils were able to do by the help of the dictionary. It was soon found, however, that pupils could just as well repeat definitions without attaching any meaning to them, as they would spell words without attaching any ideas to them. The next step was to require pupils to incorporate the words in sentences. If the word was within the comprehension of the pupil, little difficulty was met with; but as soon as the word was beyond the pupil's understanding, sentences were either copied from the dictionary, or nonsense was the result.

The lamentable deficiency of pupils in spelling has been deplored *ad nauseum*. That this deficiency may be ascribed, in part, to the construction of the English language, cannot be doubted. But, on the other hand, the manner of presenting the words to be spelled is the primary

cause of poor spelling. A child, like a grown-up man, will, in writing, use only such words as it has assimilated, partially at least. In other words, the vocabulary of a child is co-extensive, in a general way, with its mental development. The mental development of a child is dependent upon the studies it is pursuing; and the words occurring in the child's reading lessons, geography lessons, etc., will be the words of which it can obtain a more or less complete understanding. These words are not necessarily shorter or longer, derivative or primitive, Anglo-Saxon or Latin, according to the child's advancement. They are simply words, no matter what their length, composition, or derivation, which the child may be assumed to understand, and which it may use in writing. These are the words, then, which form the proper material for the child's spelling lessons.

Take now these same words, and isolate them, and group them in Spellers, and they may still have no meaning to the child. To understand a word, to fully grasp its meaning, it is frequently necessary that the child views the word in its relation to other words; in short, in its office as part of a thought. How true this is even in maturer and more disciplined minds, may be inferred from the necessity our lexicographers are under to illustrate the *meaning* of words by means of examples—that is, by means of sentences and passages in which the word occurs. Mere definition would be of no value in the majority of cases. Hence for a child to understand a word, it is necessary, first, that the word be within its understanding; and second, that the word be not presented isolated, but in relation, that is, as forming a part of a sentence or thought.

Taking as granted that a child should be required to spell only words to which it attaches an idea, it will be seen from the above that in the majority of cases a child should spell a word only as it occurs in the reading lesson, or in some other lesson; that is, as the word is seen in its office as part of a thought. These considerations will show the necessity of discarding Spellers, and upon depending upon the general lessons and exercises for the spelling lessons.

Spelling depends, first, upon the knowledge of the letters composing a word; and second, upon the ability to write these letters in their proper order. That the second is not a necessary result of the first must be known by all who have taught. A child may be able to spell a word orally, and yet make even gross errors in writing the word immediately afterwards. It takes years of practice to enable a child to write every word just as it knows it should be spelled. First, the eye must become fitted to perceive with accuracy words in their printed or written forms, and the ear must learn to hear aright with equal accuracy. Secondly, the pen must execute what the eye and ear perceive. Herein lies the whole secret of orthography.

In this manner we learn the spelling of technical words, or words occurring only in special studies. In this manner, foreigners learn English spelling, and this is the only logical manner for children to learn spelling. This method will insure not only correct orthography, but it will also insure a more thorough studying and more complete understanding of the several lessons.

It will be seen from the above, that written spelling is the principal method of teaching correct orthography. From what we have said about the necessity of showing the word in its office as part of a thought, it will also be clear that dictation exercises of isolated words are not as valuable as the writing at dictation of whole paragraphs of the lessons,

or of sentences unlike those found in the book. Copying the different lessons is a useful and indispensable exercise. The words tabulated at the head of the reading lesson, words in common use, the new words occurring in object lessons, geography, and other lessons, should be neatly written by the pupils on their slates and on the blackboard; and the more difficult words should be written in columns on the blackboard, and frequently read and reviewed. But the first requisite in all these exercises is that the pupil be never allowed to write by himself. The teacher must so appoint the length and time of his exercises that he can carefully scrutinize every slate. Nothing must be allowed to be written without exact correction. Inattention to this will soon make the pupil incorrect by familiarity with his own errors. Misspelled words should be given to the pupil or the class at the next exercise; and it is best that the misspelled word be rewritten correctly, and in such a position that the false and true spelling may be seen at a glance.

If by this method even only one page a week be copied and written at dictation, the pupil will have advanced farther in orthography than by spelling a dozen columns of the Speller.

Oral spelling is not to be discarded altogether, it is simply to be relegated to the subordinate position occupied by it in practical life. Frequent occasions will be found for oral exercises; and such occasions must be fully made use of. At the close of every reading lesson, the words at the head of the lesson, and such words as the teacher may select from the body of the lesson, should be spelt orally. It must be remembered that the minimum requirement for each division or grade, is the ability to spell orally, or write at dictation, any word or paragraph of the reading lesson, and the technical words used in the several branches taught.

As soon as the advancement of the pupil will allow, the most general rules of spelling and etymology should be learned and constantly applied. A knowledge of the most common prefixes and suffixes—so indispensable to accurate and intelligent spelling—can be easily acquired by any pupil reading in the Second or Third Reader. Care must be taken, however, not to enter too soon upon word analysis proper. A child may easily learn that *dis*, *un*, etc., mean *not;* and it may be able to analyze dislike into *not* and *like;* but it will require a pupil far more advanced to enter upon the study of the roots of words.

6.—INSTRUCTION IN LANGUAGE.

In the old course, no special attention was required to be given to instruction in language till the sixth school year. Then grammar was introduced by means of a text-book, and composition by means of written exercises. In the revised course, instruction in language is required to be given from the first school year on.

First School Year.—The pupil to be required to answer and speak in complete sentences. Spontaneous expression of the pupil's thoughts to be encouraged. Systematic correction of common faults in the use of language to be commenced in this, and continued through all succeeding divisions.

Second School Year—*Composition.*—At first merely imitative. Copying words and sentences printed on the blackboard by the teacher. Use of period at end of every sentence, and use of capital in first word of every sentence. The children are to be encouraged to write sentences of their own as soon as the number of words learned will permit. Just

as soon as a few names of objects, a few words expressive of quality, and a few words of action are learned, so that they can be read and written, let such objects be exhibited and such actions performed in the presence of the child as shall require, in description or narration, the use of the words learned. Great care must be taken not to make these exercises so difficult as to discourage the children. Spontaneous efforts, even the rudest, should be freely praised.

THIRD SCHOOL YEAR—*Composition.*—Writing sentences containing given words. Pupils to describe the pictures in their Reader, and to be encouraged to tell what they show. Short descriptions derived from these pictures and from object lessons. Accounts of things done. Every child in this division should be able to write his own name, the name of his teacher, and of the nearest Post Office. Systematic exercise in the use of *have, do, be, see,* and in correction of common faults in the use of the same. The work of the term or year should make the pupil acquainted with the use of the capitals for the pronoun I, and in the beginning of sentences, in the names of persons, days of the week, the month; also, the use of the period and the interrogation mark.

FOURTH SCHOOL YEAR—*Composition.*—Writing sentences containing words selected from the reading lessons. Descriptions derived from object lessons and pictures. Narration of actions performed by the teacher and by the pupils under the direction of the teachers. Punctuation marks as needed.

FIFTH SCHOOL YEAR—*Composition and Oral Grammar.*—Writing sentences containing nouns, verbs, and adjectives, and selecting the same from the Reader. Writing sentences predicating actions and qualities of given objects, selecting words from the Reader which denote action and quality. Predicating action in time past, present, and future; introducing modifiers of the verb (adverbs) to tell where, how, and when. The adverb.—Selecting words from the Reader which denote action present, past, and future. Composition based on object lessons and geography lessons. Use of punctuation marks.

SIXTH SCHOOL YEAR—*Composition.*—Exercises in narration. Descriptive exercises to be commenced. Geography lessons and object lessons will furnish abundant material. Letter writing. Use of punctuation marks. *Grammar.*—Oral deduction of rules for changing nouns from singular to plural. Distinction between the forms of the adjectives denoting different degrees of quality. Subject and predicate to be introduced. Selection from the Reader of the parts of speech already introduced. Personal pronouns, conjunctions, and interjections. Synthetic exercises, embracing modifications of subject and predicate, to be introduced as rapidly as the progress of the class will permit. Person and gender of nouns and personal pronouns.

SEVENTH SCHOOL YEAR—*Composition.*—Narrative and descriptive exercises extended. Letter writing from pupil to pupil, pupil to teacher, and pupil to parents and absent relatives on the business and lessons of the school. Manner of addressing letters. *Grammar.*—Synthetic exercises; the subject modified by words and phrases. The predicate modified by the same. The adjective and adverbial element to be modified. The verb—transitive and intransitive. The objective element. Introduction of case. Regular and irregular verbs. The clause to be introduced. Selections from the Reader of all the parts of speech. Verb—active, passive, and neuter. Tense. Analysis of simple sentences. The subject a word, phrase, and clause; the predicate a noun,

an adjective, a verb. Use of Brown's First Lines of English Grammar, to page 74, at option of teacher.

EIGHTH SCHOOL YEAR—*Composition.*—Narrative and descriptive exercises extended. Business letters may take the place of other letters. *Grammar*—Brown's First Lines completed.

Under "Instruction in Language" we include instruction both in grammar and in composition. These branches of study are generally made too technical, and the result is a skill in the enunciation of rules, and an utter ignoring of those very rules in speaking and writing. The use of good and correct language is the result more of habit than of technical study. Hence "every exercise of the school-room, in which words are either spoken or written, should be made an exercise in the use of language." "Great attention," says Hon. J. G. McMynn, "should be given to the language used in the school-room, both by teachers and pupils. It should be pure English, free from all provincialisms; and the construction of the sentence should be grammatical. It is of the utmost importance that the teachers of our primary schools should be accurate in the use of language; quick to notice, and prompt to correct all 'bad grammar' heard in their school-rooms. No *slang,* no undue expletives, no unnecessary repetition, no obsolete words, no violation of orthography or syntax should, at *any time,* or under any circumstances, be allowed to pass without careful correction. The power of expression may be cultivated by 'Object Lessons' and conversation. Pupils should also be advised and required to write much. Recitations may sometimes be conducted by writing, and will be found profitable. Questions should be pointed and precise; answers should be concise and exact. Every answer should embrace a complete proposition. Frequently the pupil gives the answer only in part. Every exercise, and every recitation, should be so conducted as to habituate the scholars to correct, terse, and elegant modes of expression. All indistinctness of utterance, all clipping of words, all hesitancy of speech, should at once be noticed, and the proper remedies faithfully applied."

The technical study of grammar and composition must be based upon the reading lessons. The reason for this will be plain from a careful consideration of the following extracts from an article on the "Fundamental Principles of Teaching Language," published in the *Teacher* for May, June, and July, 1873:

"The written language is, for the scholar, something different from the language of ordinary conversation, and even in this latter he is not perfectly accomplished. How then is the child to be expected to put his thoughts on paper in written language before the genius of the language has, to a certain degree, ripened within him—before he has acquired a knowledge of the most important rules of grammar? The child must necessarily commit errors in style, and the worst of it is, he has no idea that what he has written can be faulty. He is capable neither of *understanding* nor of *feeling* his errors. Thus his very exercises in expressing his thoughts in language become the means of corrupting, of preventing, his sense of the genius of the language, its spirit, its feeling.

"Above all things else the genius of the language studied is to be cultivated; this, it is easy to see, is not attained by the literary efforts of the scholar, but by choice selections for reading. Therefore, in order

to cultivate in the learner the genius, the spirit of the language, I am most thoroughly in favor of assiduous and frequent contemplation, perusal, discussion, copying, and committing to memory of good selections, and as thoroughly opposed to premature, unaided writing of the language studied. Whoever confines himself in the lower classes to this will, in the higher classes, have reason to rejoice at the result. But let us ask what is the aim of early, unaided, written exercises? In orthography and manner of expressing one's self surely nothing is gained, but much may be corrupted. Is it for the purpose of forcing children to think? Let us not forget that the effort of the child to think for himself and by himself is often not worth a penny; and, at the most, exercises of this kind are merely a mechanical effort, the occasion for the exercise of the memory. The teacher who thinks, will in his teachings in the school-room sufficiently incite thought in his pupil.

"*Instruction in language is to be associated with selections for reading.* The aim of instruction in language is not to add to the knowledge (historical, geographical, or other,) of the pupil; just as little has it for aim to exercise the power of thought. Certainly, instruction in language will be, should be, and must be an exercise of the thinking powers, but this is not its *aim*. Such instruction is rather mutual action, reciprocal effect of thought and speech. For this reason the so-called 'exercises in thinking' can be advantageously combined with the teaching of language, and *vice versa;* at least they may mutually aid each other.

"The aim of instruction in language is this:

"*First*—To make the language of literature, or, what should be the same thing, of cultivated people, intelligible to the pupil.

"*Second*—To render the pupil capable of expressing himself in the language studied.

"Without the first, the second is not possible; let the first be attained and the second comes of itself.

"If the real purpose of instruction in language is expressed in the above words, then the first and indispensable means thereto is the speaking in a cultivated style to the pupils, and the reading to them of select literature from books. Such means will effect more than all other means together.

"But that this method should have its full influence, instruction in language has, for its task, to guide the learner and to accustom him not merely to the intelligent comprehension of *thoughts* spoken, written, or printed, but also to the *manner* in which those thoughts are *expressed.* But this guiding and this familiarizing of the learner, is less easily effected by means of what is spoken than by means of what is done; that is of what lies printed or written before the pupil, whereby, at the same time, the receptive power of the mind is aided by a second sense, that of the eye. For example: is it not quite another thing when the scholar sees before him the changes in the declension of a word, from what it is when he has to find out, merely by the ear, what changes the word undergoes? Hence the knitting on, if we may use the expression, of the instruction given in language to some piece selected for reading, is far preferable to every other art and manner of teaching.

"Here the groundwork is laid on which the teaching of grammar is to be built up, and hereby the pupil learns to feel those forms of speech, and the relations of the different parts of a sentence to each other, which it is the province of grammar to elucidate. From the language itself the child learns to discover the rules of the language, and this is

exactly as it should be. In the old method of teaching language it would never occur to the child in reading to think of the structure of a sentence, of its separate parts, its principal words, etc. In the new method the child will and must learn early to think of these things, because, in exercises of expression, he has become familiar with them. What an advance in the linguistic career of the scholar!

"Let it not be understood that in the teaching of language the reading of detached, though complete, sentences is sufficient, but the reading must be of selections taken as a whole, finished in themselves, in style and in thought.

"Taken in a wide sense, the teaching of language in our schools has for its purpose to regulate, correct, and enlarge the pupil's sphere of thought; to practice him in the certain and quick comprehension of what he reads and hears, and in the clear and correct expression of his own thoughts and of the thoughts of others. This purpose is accomplished principally by means of varied exercises, and by cultivating the feeling of the genius of the language. Thus our teaching of language aims at making the language of eloquent discourse and literature intelligible to the pupil."

In speaking of reading (see page 25*, *et seq.*), we explained the composition of a complete reading lesson, and gave also the requisites for correct and good reading. The conditions there given being fulfilled, and the requirements satisfied, the foundation is laid to enable the pupil to express himself in grammatical, refined, and elegant language. The means are thus indicated which are to be used by the teacher in order to accomplish the purpose of instruction in language. By the application of these means more will be gained in enabling learners to understand and use written language than by all other methods heretofore in use. Let us now designate the main points in the plan of teaching language; these, however, need not necessarily be considered in the following order:

"This instruction is to be given conjointly with a reading-lesson. The reason why is found in the foregoing. But it is not meant by this that *all* oral instruction or discussion in regard to language, not connected with a reading-lesson, is to be avoided. On the contrary, such separate discourse is often advisable." To connect in the most profitable manner, instruction in language with object lessons especially, it is a prerequisite that such lessons be conducted as indicated in the concluding paragraphs of our article on *Mental Discipline.* (See page 24*.)

The manner of reading, explaining, and analyzing the reading lesson was pointed out above, page 25*. For the sake of the perspicuity, however, we repeat what we said there:

"1. The reading lesson is to be read by teacher and by pupils in conformity with the requirements given on page 93, and when too long, or when the ability of the pupil is insufficient, then, by questioning, let it be drawn out by sections or paragraphs from the pupils themselves; or, when possible, let them repeat it by sections.

"2. Unintelligible or obscure expressions which, in reading, questioning, and recitation, have been brought to the notice of the teacher, are to be explained to the pupils, and erroneous ideas corrected.

"3. The reading lesson is to be considered in its separate sections—that is, the principal or larger groups are to be noticed.

"4. The different thoughts contained in the separate sections or

larger groups of thoughts are to be so brought out that the learner becomes aware of them. By mere reading, these thoughts pass in too quick succession through the child's mind, so that often the child does not know what he has read.

"5. The particular manner of utterance or expression of these separate thoughts is remarked upon; also the reference or relation of these thoughts to each other, and herewith we enter upon the proper and peculiar sphere of instruction in language. Here the attention is to be fixed upon the separate sentences of the reading lesson, and the pupils must learn to perceive the signification of the phrases and separate parts of the sentence, their relation to the complete sentence, and the ideas and forms of words, etc., thus introduced. Still further, this will lead us to notice classes and families of words, separate words, and the manner of writing them. In this treatment of Instruction in Languages in its essential characteristics, we would offer to consideration the following points confirmed by our own experience:

"1. Not to dwell too long upon the reading of one and the same piece. In general, but few lessons are to be given to one selection. Otherwise, besides the danger of losing the interest of the pupil, we also fail of our aim in bringing before the young mind many and varied forms and structures of language—language pictures—and neglect many other things already mentioned. What one is thus obliged to omit in regard to one piece selected for reading, can be introduced in regard to future ones.

"2. In this method of linking instruction in language to a reading lesson, it is necessary to keep to some systematic order of gradual progress. By this I mean that the teacher is not to lay hold indiscriminately of some reading lesson, and then speak promiscuously of grammar, orthography, etc.; but that, having fixed upon the subject-matter to be taught, and arranged it in the form of a successive series, he shall, in connection with this selection for reading, take up one or more of these themes according to their order. Whatever is introduced that is new to the scholar, must be held before him until he has obtained a conscious knowledge of it, although it may not be possible to dwell upon it till it becomes fixed in his mind. Hence, the advancement made is but slow. If necessary, one and the same theme may be made the subject of several selections for reading. When the whole series, or a greater part of it, has been concluded, then make a summary review.

"3. What has already been treated of is to be renewed, and fixed in the mind of the learner by continual repetition. This can be done, in part, in reading lessons in which something new is to be developed, and, partly, in reading lessons selected at pleasure, solely for the purpose of review.

"4. Minor items, for example, that an interrogation point is placed after a direct question; that the name of a person is always commenced with a capital letter; as, also, the particular place in which he resides, etc., may be introduced at pleasure, wherever the reading lesson offers opportunity.

"5. It is not necessary, in the discussion of a reading lesson, studiously to exclude all and everything which, according to the teacher's plan, should be fully treated of only at a later period. If an especially appropriate opportunity offers, or if it is necessary to the understanding of anything, then, so far as needed, let the teacher make previous mention of these things.

"6. Oral instruction is to be aided by written exercises. Of this it

is necessary to speak more fully. The need of such written exercises rests not merely on the desire to fill up certain school hours, or to give suitable employment to the child at home, but also on the fact that in oral exercises the minds of the scholars of the class are not all equally active, that we cannot take so especial a hold of the thought of each as in written exercises. As a rule, in oral questioning, only the one to whom the question is addressed becomes fully active in thought; while with a larger part of the remaining scholars, who are interested to a greater or less degree, the attention paid is, at least, less spontaneous. In written exercises, on the contrary, every scholar must give his full attention and turn his whole mental power to the subject before him.

"To obtain, in oral exercises, from each pupil the same degree of spontaneous activity which is aroused by written exercises, would involve a greater expenditure of time than a teacher can usually afford. The teacher would never have time enough to convince himself whether each separate scholar had fully comprehended the subject spoken of, or to what degree he had comprehended it. Thus, for this reason, too, are written exercises necessary, if the teacher does not wish to go on building up a structure without knowing beforehand that a sure foundation has been laid by each of his pupils. The examination of these written tasks will first render it possible for him to gain a correct knowledge of the result, in each of his pupils, of his teaching, while, at the same time, it will serve as a necessary guide for subsequent oral instruction; such knowledge is, moreover, indispensable to every teacher who does not desire to beget in his pupils a knowledge that is broken, disjointed, unconnected, and often erroneous. But granted that the teacher has sufficient time for such oral exercises, he would hardly avoid a certain sense of tediousness, which enters with the diminution of mental activity in a majority of the pupils. It would be chiefly among the most ready and capable scholars that a condition of restlessness and uneasiness would arise as soon as the teacher should be forced (an unavoidable circumstance) to busy himself with those naturally more dull. Nothing is more dangerous to the child's interest in learning, and also for discipline, than this sense of tediousness and the uneasiness and discomfort proceeding from it. Hence oral exercises must often be interrupted at a point when, for a larger or smaller part of the pupils, it is necessary to continue them. This continuation constitutes the written exercises which again force the more capable scholars to spontaneous activity.

"The result of all this is the necessity of written exercises demanded by instruction in language in its different branches; and, from these points of view, instruction in language, in its treatment of each of its different subjects, divides itself into three departments. These are: First—Awakening of the intellect. Second—Oral exercises. Third—Written exercises.

"The question, as to what constitutes the special province of these written exercises, is easily answered by pointing out that they should be nothing else than a continuation of the oral exercises. One must also know what oral exercises are to be linked to every rule of orthography, grammar, or rhetoric which has come under discussion with the pupils. Since, however, all oral instruction cannot be adapted to written exercises—many because requiring too much assistance from the teacher, others because too lengthy for written recital, or because beyond the orthographic skill of the pupils—a selection must be made suited to conditions, and what is to be required stated somewhat in this form: All oral exercises must also be prepared in written form, so soon

as this form does not exceed the capacity of the pupils. The more nicely graduated the steps of the course, from easier to more difficult, which the teacher follows in these exercises, so much greater the number of exercises possible."

7.—ARITHMETIC.

Arithmetic, in the old course, was taught, during the first school year, by use of objects, as beans, marbles, numeral frames, etc.; Arabic and Roman numerals to ten, might be taught from blackboard; counting to one hundred. The revised course provides that clear and ready perceptions of numbers from one to ten are to be developed by use of objects, and at every successive step all possible additions, subtractions, multiplications, and divisions of integral numbers are to be learned within each limit as it is reached.

For the second school year, the old course taught Roman numerals to fifty, counting by twos, threes, fives, and tens, to two hundred; adding and subtracting to fifty, using no figure larger than six. The revised course requires exercises, mental and written, in addition, subtraction, multiplication, and division of numbers, from ten to twenty-five, in continuation of the work laid down for the preceding year; clear and ready perceptions of numbers from ten to one hundred. The child having obtained clear perceptions of the enumeration of tens, the same work must be performed upon them which, in the preceding year, was performed upon units, but with this difference: that while tens are to be added to tens, or subtracted from tens, they are to be multiplied or divided by no number exceeding nine.

In the third school year, the old course introduced Robinson's Progressive Primary Arithmetic to page forty-two; required counting by twos, fives, tens, and twenties, to two hundred, forward and backward; Roman numerals to two hundred. The revised course retains the text-book, at option of teacher, and requires exercises in notation and numeration to one thousand; exercises, mental and written, in addition, subtraction, multiplication, and division of numbers within one hundred, the sum or product in no case to exceed one hundred; in addition, subtraction, and multiplication, the units to be added, subtracted, or multiplied first, then the tens; principles of carrying forward and borrowing illustrated; in division, the tens to be divided first, then the units; multiplier and divisor not to exceed nine; same operations to be performed upon hundreds as performed in preceding years upon units and tens; ideas of vulgar fractions to be developed, notation of same to be taught to ninths; same operations upon these fractions as upon the numbers from one to ten in the first school year; Roman numerals to C.

For the fourth year, the old course provided Robinson's Progressive Primary completed; multiplication table taught forward and backward as far as six times twelve; slate and blackboard drill exercises in addition, subtraction, multiplication, and short division daily. The revised course provides enumeration and notation to millions; exercises in addition, subtraction, multiplication, and division of numbers to one million, multipler and divisor not to exceed nine; reduction of mixed numbers to improper fractions, and the contrary; division of fractions having one for numerator by whole numbers (divisor not to exceed nine), illustrated objectively; Roman numerals finished; Robinson's Progressive Primary Arithmetic finished, at option of teacher.

For the remaining school years the revised course remains the same

as the old course, except that Robinson's Rudiments of Arithmetic has been substituted for the Progressive Practical, in the fifth and sixth school years.

Mental arithmetic holds the first place in importance in every-day life, for the greatest part in common business computations is done without the aid of paper, slate, or pencil. Accuracy in analysis, and facility in computation, are the aims of the study of mental arithmetic; and the analysis of the examples in mental arithmetic are usually the best means of leading to a solution of the more difficult problems of written arithmetic. Hence, mental and written arithmetic should be always combined.

Whilst written arithmetic is, so to say, reduced to a secondary position, yet it is of the utmost importance to teach it—on the slate and blackboard, from the lowest class upwards. The analysis furnished by mental arithmetic should be frequently written out in full, so as to serve as a model for the solution of more difficult problems in written arithmetic involving the same principle. But the rule must be always, that every example in written arithmetic which readily admits of it, should be solved without the aid of slate and pencil.

The child is not to be taught, *cannot* be taught, the science of number. The child can deal with number only as a property of bodies. Hence, the child's ideas of number are dependent on the actual presentation of objects; and every step in arithmetic must be illustrated by the things which the child sees about it. Every relation between numbers, every principle of arithmetic, whether of numeration or of one of the four fundamental operations, must be taught by the help of objects, such as the balls of the abacus, marbles, pencils, sticks, or marks on the blackboard, etc. In the first school year *units* are considered; in the second school year *units* are grouped in *tens*, and tens are considered; in the third school year *tens* are grouped into *hundreds*, and hundreds are considered. To teach, as above indicated, in the first school year, single objects are presented to the class; in the second school year, groups of objects consisting of ten each; in the third school year, groups of objects consisting of one hundred each.

Under the old course, arithmetic was seldom taught until the child was old enough to use a text-book; and there were plenty schools in which pupils of three or four years standing, and who were reading in the Third or Fourth Reader, had received no instruction whatever in arithmetic, except, perhaps, in counting to one hundred. When arithmetic was taught, it was mainly by requiring pupils to memorize tables and combinations. Thus, addition, subtraction, multiplication, and division were taken in their regular order. First, in the Primary Arithmetic, then in the Intellectual, and thirdly, in the Practical. Each of them began with addition, and every year or two the pupil found himself confronted by the old processes in their regular order. Grube, Wiedeman, and others proposed a different system. Grube, "within the limits of the small numbers, took up each of them, commencing with 1, and taught the child all there is to know about it, before he passed over to another number. Treating, for instance, the number 2, he made the children perform all the operations that are possible within the limits of this number, no matter whether, in the usual classification, they are called addition, subtraction, multiplication, or division. The child had to see and to keep in mind that $1+1=2$, $2\times1=2$, $2-1=1$, $2\div1=2$, etc. The whole circle of operations up to 2 was exhausted before the child progressed to the consideration of the number 3, which was to

be treated in the same way. Why adhere to the more scientific categories of addition, etc., in the primary grade, when they do not help to make the subject any clearer to the child? The first four processes are naturally connected, and will appear so in the child's mind. If you take away 1 from 2, and 1 remains, the child, from knowing this, also understands implicitly the opposite process of adding 1 to 1, and its result. Multiplication and division are, in the same way, nothing but another way of adding and subtracting, so that we might say one operation contains, and may be shown to contain, all the others. 'You must teach the child to know the numbers in some one way or other,' says Grube, 'but to know a number really means to know also its most simple relations to the numbers contained therein.' Any child, however, who knows a number and its relation, must be able also to perform the operations of adding, subtracting, etc., with it, for they are the direct result of comparing or 'measuring' two numbers with each other. Only when the child can perform all these operations, for instance, within the limits of 2, can it be supposed really to have a perfect knowledge of this number. So Grube takes up one number after the other, and compares it with the preceding ones, in all imaginable ways, in regard to addition, subtraction, multiplication, and division. This comparing, or 'measuring,' takes place always on external, visible objects, so that the pupil can see the objects, the numbers of which he has to compare with each other."—Louis Soldan, Assistant Superintendent of Saint Louis Public Schools.

This method of teaching arithmetic rests not only on a sound philosophical basis, but it has proved superior in practice to the methods in use before its invention. To illustrate the method, an outline is given of the work required to be gone through with in the first three school years.

Instead of first teaching to count from 1 to 2, and then to add from 1 to 10, etc., the number 2 is first taken, then the number 3, then 4, and so on, counting as far as each, adding, subtracting, multiplying, and dividing each, in every way possible, without using any figure not yet reached.

In this method there are ten steps for mental reckoning, and twelve for slate exercises, thus:

A. Mental exercises (take the number 3, for example):
1. Making the number. ($1 + 1 + 1$.)
2. Counting forwards. (1, 2, 3.)
3. Counting backwards. (3, 2, 1.)
4. Addition. ($2 + 1$. $1 + 2$.)
5. Subtraction. ($3 - 1$. $3 - 2$. $3 - 3$.)
6. Multiplication. (3×1. 1×3.)
7. Analysis. ($3 = 2 + 1$. $3 = 1 + 1 + 1$)
8. Division. ($3 \div 3$. $3 \div 2$.)
9. Comparison. (3 is 1 more than 2; 2 more than 1.)
10. Illustrative problems. (Charles has 2 slates and has bought 1 more; how many slates has Charles now?)

B. Slate exercises.
11. Most of the above exercises, with various marks.
(| | + | = | | | . | + | | = | | | .)
12. The same in figures. ($2+1 = 3$. $1 + 2 = 3$.)

It is considerable work to thoroughly go through these exercises on every number from 1 to 10, but it can be completed in the first school

year; and, being done, we may be assured that the pupils will not only have a satisfactory idea of these numbers, but will also have laid a good foundation for their future progress in arithmetic.

PRACTICAL ILLUSTRATION OF THIS METHOD, TAKING THE NUMBER TWO.

A.—*Mental Exercises.*

I. Composing the Number.—Show me one hand. How many hands are there? There is one hand. Can you show me one hand more? Repeat: there is one hand more. How many hands are there now? How many hands have you then? We have two hands. The same exercise with arms, eyes, cheeks, ears, etc.

How many ears has a cat? A cat sometimes catches a little mouse. How many ears does the mouse have? etc., etc.

II. Counting Forwards.—I place one soldier on the desk, and at a little distance, two soldiers. How may soldiers are here? Two. Repeat: there is one soldier, there are two soldiers.

The same exercise with balls on the abacus, and with other objects.

Blackboard.—I write one dot, and at a little distance, two dots. How many dots are here? One. How many here? Two. Now we will count quickly: one, two. What comes first? One. What next? Two.

We have now counted. What have we done? Because we first said the *smaller* number, one, and then the number that means more than one, two, we say we have counted *forwards*. What do we say? Now, count forwards once more. Again, louder.

III. Counting Backwards.—Watch closely what I am going to do. How many balls have I here? Two. How many here? One. How many came first? Two. How many next? One. When we count this way which number must we take first? Two. Which then? One. So, now we count two, one. Count that way yourselves. This time we have said the *larger* number first, and then the smaller, have we not?

The same with other objects. Repeat this many times, always with new objects.

On the Blackboard.—How many crosses have I made here? Two. How many here? One. Which do we take first, the most crosses, or the fewest? The most. And then? The fewest.

When we count this way, first saying the greater number, and then the smaller, we count *backwards*. What do we do? You may count backwards once.

The same with other marks.

Now let us see if we can count *forwards* again. Give attention to what I write on the blackboard. (| | | .) Count. Look again. (| | | .) How must you count this? Backwards. Count.

IV. Addition.—Hold up one hand. How many hands are there? Hold up one hand more. Repeat: here is one hand more. How many hands are there in all? Repeat: one hand and one hand more are two hands.

The same with other objects; but always let the answers be given in a complete sentence, thus: One finger and one finger more are two fingers. One soldier and one soldier more are two soldiers. One ball and one ball more are two balls.

On the Blackboard.—What have I made on the blackboard now? (One ring.) What have I made again? (One ring more.) How many rings are there in all? One ring and one ring more are two rings. Repeat it after me. One line and one line more are two lines. One dot and one dot more are two dots. One cross and one cross more are two crosses.

But we can say this a shorter way; we can say one and one are two. What can we say?

V. SUBTRACTION.—How many fingers am I holding up? Two. How many fingers are there then? Two. Now, watch carefully. (I bend one finger slowly down.) Are there two fingers now? No. How many are there? One. How many fingers have I taken away? One. How many fingers remain, then, if you take one finger from two fingers? When you take one finger from two fingers, one finger remains.

The same with other objects.

We can say this a shorter way, also; we can say: one from two leaves one; or, two less one is one.

Two boys. How many boys do you see by me? Two. I will put one of them behind the door. How many do you see now? One. How many boys less than there were? One. How many were there at first? Two. When there is one boy less there is only one boy; so we can say: two boys less one boy leaves one boy. Repeat that. Or we can say it shorter: two less one is one. How can we say it?

Look at something quite new which I am going to show you.

How many books have I in my hand? Two. (I lay them away one at a time.) How many books have I in my hand now? Not any. How is that? Because you have just put them away. How many books did I have? Two. And how many have I laid away? Two. And how many books are left? None. Then if I have two books and take two away, how many books have I left? None.

Boys, pencils, rulers, etc.

We can say this shorter, also; we can say: two from two leaves nothing; or, two less two is nothing.

On the Blackboard.—How many apples have I drawn? Two. How many have I erased? One. How many are still there? One. (Draw trees, stars, etc.) As before: one from two leaves one.

How many straight lines have I made now? Two. How many have I erased? Two. How many are still left? None. (Dots, rings, etc.) As before: two from two leaves nothing.

Review.—How many are left when you take two away from two? How many when you take only one from two? When you take one from one?

VI. ANALYSIS OF THE NUMBER.—How many balls are on this corner of the abacus? Two. The two balls are so close to each other that they look as if they had grown together, do they not? But look, I can separate these into two parts. How many are in this part? One. And how many in the other part? One. If I shove them together we shall have a whole two again. So the number two is made of two parts. Of how many parts is two made? Each part is one ball; therefore I can say, two balls is one ball and one ball more. (Pencils, etc.)

We can say this shorter: We can say, two is one and one more.

Blackboard.—Make two straight lines. How many lines do you see? I will tie them together so that it will be a whole two. (II) Into how many parts could we divide this two? Into two parts. Let us do it. (| |) Of what is this two made? Of one and one.

VII. MULTIPLICATION.—We have seen that two is made from one and one. I will show it to you again. (Two balls close together.) That is a whole two. (Separate the two balls.) How many balls are here? One. How many here? One. Then there is one here and one here; there is only *one* ball each time. *Here* is once one ball, and *here* is once one ball. How many times, then, can you see one ball? Two times. And two times one ball are how many balls? Two balls. Repeat after me: two times one ball are two balls. We can also say it shorter, thus: two times one are two. Repeat that after me. (The same with blocks, etc.)

On the Blackboard.—Make a ring on the blackboard. How many rings have I made? You have made one ring. How many times have I made one ring? You have made one ring once. So that is once one ring. (Make another ring.) How many times have I made one ring now? You have made one ring two times. And two times one ring are how many rings? Two times one ring are two rings. Said shorter it is thus: two times one are two. Repeat it after me. Once more. Once again.

VIII. DIVISION.—James, come here to me. Take these two pencils; hold them up high. How many pencils has James? Two. Charles and John, come here. You shall divide these pencils between you. How many pencils has James? Two. How many boys are to divide these pencils between them? Two. Divide them. Hold them up high so that we can see how many each one has. How many has Charles? One. How many pencils has John? One. Then when two boys divide two pencils between them, how many does each boy receive? One. Repeat this together: If two boys divide two pencils between them, each boy receives one pencil. (Balls, slates, pens, etc.)

Result: When two is divided by two, each has one.

Blackboard.—Draw two apples not very near together. How many apples are there? Two. Frank and Willie, come here; you may divide these two apples between you. How many apples are there. Two. How many boys are to divide these two apples? Two. Now divide them. How many will Frank have? One. Let him put his finger on his apple. How many can Willie have? One. Let Willie put his finger on his apple. When two boys divide two apples between themselves, how many apples does each receive? One. When two is divided by two, each has one. Repeat it again.

IX. COMPARISON.—I call out two children and give one ball to one and two balls to the other. How many balls has Lizzie? One. How many has Mary? Two. Who of the two has the most? Mary. How many balls has Mary? Two. And Lizzie has only how many balls? One. How many has Mary more than Lizzie? Mary has one more. Then the one that has two has one more than she that has one. Repeat that after me. The one that has two, etc. How many more is two than one? Two is one more than one. (The same with other things.)

Now tell me who of the two little girls has the least number of balls? Lizzie. How many balls has Lizzie? One. How many balls has Mary? Two. How many balls has Lizzie less than Mary? Lizzie has one less. Then she that has one ball has one ball less than she that has two balls. Repeat: she that has one ball, etc. How much less than two balls is one ball? One ball is one less than two balls. We say it shorter in this way: one is one less than two.

Blackboard.—(Make one straight line, and at a little distance two straight lines). How many lines are here? One. How many there?

Two. How many more lines there than here? One. Then two lines are how many more than one line?

Result: two is one more than one.

I draw one tree and at a little distance two trees. How many trees are here? One tree. How many there? Two trees. How many less trees here than there? One tree less. One tree, then, is how much less than two trees? One tree is one tree less than two trees. Shorter: one is one less than two.

X. Illustrative Problems.—Charles had one slate, and his father gave him one slate more; how many slates had Charles then? In a garden were two apple trees; the wind blew down one of the apple trees; how many apple trees were left standing? Alfred went fishing, and twice he caught one fish; how many fishes did Alfred catch in all? If two little boys divide two marbles between them, how many marbles will each boy have? Benjamin had one picture-book and Jacob had two picture-books; how many more picture-books had Jacob than Benjamin?

B.—*Slate Exercises.*

I. Composing Numbers.—Make one straight line. Make one other straight line. How many straight lines have you made? (Dots, crosses, etc.)

II. Counting Forwards.—Make one dot. Make two dots a little way from the one dot. How many dots stand first? How many next? One, two. (Rings, etc.)

III. Counting Backwards.—Make two crosses on your slates. Make one cross a little below the two crosses. How many crosses stand first? How many next? Two, one.

IV. Addition.—If the children are to reckon on their slates in the four rules from one to ten, it is necessary for them to become acquainted with the four signs: $+ - \times \div$. This should be taught immediately with the operations on the number two. I tell them that $+$ means "and" or "add to;" that $-$ means "to take away," and is read *minus;* that $\times$ means so many times as the number expresses which stands next to it; that $\div$ means we are to divide; and that $=$ means is, are, remains, etc., and is read *equal.*

Although they do not learn immediately, and perhaps not readily, what these signs mean, yet as a general thing, they learn them after a little time, without much trouble.

For example: Make one straight mark; then make a cross; then another straight mark; then $=$. How are you to read this example? One straight mark and one straight mark are? And how much are one and one? Two. Very well; now write these two straight marks at the end: $| + | = | \; |$. (Dots, rings, etc.)

V. Subtraction.—Make two dots near together; after them make a short horizontal line ($-$); after that make one dot; then make two horizontal lines after the one dot. Tell me what the one horizontal line means. It means take away. Read the example to me. How many shall we take away? One. From what shall we take away the one dot? From the two dots. How many dots will remain? We will write the number of dots that remain after the two horizontal lines: $.. - . = .$

Of course the teacher is also to write all this, at the same time as the pupils, on the blackboard.

VI. Analysis.—We have already learned what makes the number

two. What is the number two made of? One and one. We will now make the number two on the blackboard and slates. Make two straight marks; after them make two short horizontal lines. What is it that makes the number two? We will write that next. First make one straight mark. What sign means "and?" A cross. Make such a cross. Now it is read "two is one and." What must we add to that. One straight mark more. Make it. Let us read this example: $| \; | = | + |$.

VII. Multiplication.—How many was two times one? Two. Let us write that on the slate. Make two straight marks. That is a two. Now we will make a cross of two slanting lines ($\times$). This cross tells us that we shall take some number as many times as the number that stands before the cross. In short, this sign means "time" or "times." Tell me what you have on your slates now. Two times. Now make one straight mark more, and after it two short horizontal lines. Read what you have on your slates now. Two times one is. Tell me, how much is two times one? Two. Very well. So we have only to put two more straight lines at the end of what we have written and it is finished. Read the whole of what you have written: $| \; | \times | = | \; |$.

VIII. Division.—Do you remember how much each one receives when you divide two things between two persons? One thing. When we wish to divide anything we make this sign: $\div$. What does this sign tell us to do? To divide. Now, make two straight marks on your slates. These two marks are to be divided, therefore, what sign must we write after them? Two dots, with a horizontal line between them. These two marks are to be divided into two parts; therefore, after the sign you must write two marks and then two straight horizontal lines. How must you read what you have written? Two divided into two parts. How much will there be in each part? One. Then what must we write at the end? One mark. Read what you have written: $| \; | \div | \; | = |$.

IX. The Figures.—Make two dots, rings, etc. How many dots are there? Two. Then that is the number two. But grown people write the number two another way; they write it like this: 2. How many does this figure (2) mean? It means two. Now write a two as grown people write it.

Again: How many hands have you? Two. If you wished to write that, how many straight marks would you have to make? Two. But your mother would write it another way. If she wishes to write that there are two eggs in the closet, she does not make two straight marks, but she make the figure two, thus; 2. This figure means just the same as the number two or as two straight lines. It makes no difference whether we write two straight marks, two rings, two dots, or the figure 2.

C.—*Written Arithmetic with Figures.*

I. Addition.—You have learned to make two figures; what are they? One and two. Let us try to write with these figures. Pay attention. I write: $1+1=$. Read what I have written. One and one is. How much is one and one? Two. What figure must I write at the end? A two. $1+1=2$. You may now write the same on your slates.

II. Subtraction.—I write the figure 2. How much does that figure mean? It means two. I write a horizontal line thus: $-$ after the figure 2. What does that horizontal line mean? It means to take away

from. I now write the figure 1 and two horizontal lines after it. How shall we read what I have written? Two, one taken away, is; or, two minus one is. What remains when I take one away? One remains. Then what figure must I write at the end? The figure 1. 2—1=1. You may now read it.

III. ANALYSIS.—What is it that makes two? One and one. Let us write that with figures. Make the figure 2. After the figure make two short horizontal lines, thus: =. You say two is made from one and one; how many ones must we then make after what we have already written? Two ones. Make them. I also make them, but write them purposely, thus: 1 1. Read that. One, one. But it must be one *and* one. What sign must we put between the ones? A cross. Make a cross (+) between the figures. How must we read the whole of what we have written? Two is one and one; or, two equals one and one. 2=1+1.

IV. MULTIPLICATION.—Let us now reckon how many times one is. How much is it? Two. Let us first write it with straight marks, as we did before, thus: | | × | = | |. How do we read that? We will now try to write it in figures. What shall we write first? A figure 2. What next? The sign for "times." What next? A figure 1. How do you read that? Two times one. Now write two short horizontal lines. How much is two times one? Two. Then what must we write last? Two. 2×1=2. You may now write it on your slates.

V. DIVISION.—Now we will divide; and let us try that also with figures. How was the sign of dividing or division made? Two dots with a horizontal line between them. We want to divide two cherries between two boys. We must first write what we wish to divide: 2÷. How many boys are to divide them? Two. What figure must we next write? The figure 2. 2÷2. Read what we have now written? Two divided by two. Make two short horizontal lines. How many cherries will each boy receive? One cherry. Therefore, what figure must we write at the end? The figure 1. 2÷2=1. Very well. You may now write it on your slates.

The foregoing is sufficient to show the method to be applied successively to each number from one to ten. Such teaching is indeed a hard task for the teacher's voice; but the arithmetic lesson must ever be considered the hardest in the lower classes, for, added to the great strain on the teacher's vocal powers, it is very difficult to maintain order and the usual school discipline and at the same time to keep the young minds interested and enthusiastic in the lesson. Moreover, it looks more difficult on paper than it is in practice. Again, no method can be exactly suited to every teacher; the individuality of the teacher must always have scope; let the teacher only never neglect thoroughness, perception, and variety of application.

The following tables will give an idea of how the exercises on the slate should be performed, both with straight marks and figures, taking the number six as an example:

A.—WITH STRAIGHT MARKS.

1.—*Composing the number.*

1 1 1 1 1 1

2.—*Counting forwards.*

1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1
	1 1
	1 1 1
	1 1 1 1
	1 1 1 1 1
	1 1 1 1 1 1

3.—*Counting backwards.*

1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1
	1 1 1 1 1
	1 1 1 1
	1 1 1
	1 1
	1

4.—*Addition.*

1+1	1+1 1	1+1 1 1	1+1 1 1 1	1+1 1 1 1 1
1 1+1	1 1+1 1	1 1+1 1 1	1 1+1 1 1 1	
1 1 1+1	1 1 1+1 1	1 1 1+1 1 1		
1 1 1 1+1	1 1 1 1+1 1			
1 1 1 1 1+1				

5.—*Subtraction.*

1—1	1 1—1 1	1 1 1—1 1 1	1 1 1 1—1 1 1 1
1 1—1	1 1 1—1 1	1 1 1 1—1 1 1	1 1 1 1 1—1 1 1 1
1 1 1—1	1 1 1 1—1 1	1 1 1 1 1—1 1 1	1 1 1 1 1 1—1 1 1 1
1 1 1 1—1	1 1 1 1 1—1 1	1 1 1 1 1 1—1 1 1	1 1 1 1 1—1 1 1 1 1
1 1 1 1 1—1	1 1 1 1 1 1—1 1		1 1 1 1 1 1—1 1 1 1 1
1 1 1 1 1 1—1			1 1 1 1 1 1—1 1 1 1 1 1

6.—*Analysis.*

1 1 1 1 1 1=1+1+1+1+1+1	1 1 1 1 1 1=1 1 1+1 1+1
1 1 1 1 1 1=1 1+1+1+1+1	1 1 1 1 1 1=1 1 1+1 1 1
1 1 1 1 1 1=1 1+1 1+1+1	1 1 1 1 1 1=1 1 1 1+1+1
1 1 1 1 1 1=1 1+1 1+1 1	1 1 1 1 1 1=1 1 1 1+1 1
1 1 1 1 1 1=1 1 1+1 1+1	1 1 1 1 1 1=1 1 1 1 1+1

7.—*Multiplication.*

1×1	1×1 1	1×1 1 1	1×1 1 1 1	1×1 1 1 1 1	1×1 1 1 1 1 1
1 1×1	1 1×1 1	1 1×1 1 1			
1 1 1×1	1 1 1×1 1				
1 1 1 1×1					
1 1 1 1 1×1					
1 1 1 1 1 1×1					

8.—*Division.*

l l÷l l=l	l l l÷l l l=l	l l l l÷l l l l=l
l l l÷l l=l.	l l l l÷l l l=l.	l l l l l÷l l l l=l.
l l l l÷l l=l l	l l l l l÷l l l=l.	l l l l l l÷l l l l=l.
l l l l l÷l l=l l.	l l l l l l÷l l l=l l	l l l l l l÷l l l l l l=l
l l l l l l÷l l=l l l	l l l l l÷l l l l l=l	
	l l l l l l÷l l l l l=l.	

9.—*Comparison.*

l l is l more than l	l l l is l l more than l
l l l is l more than l l	l l l l is l l more than l l
l l l l is l more than l l l	l l l l l is l l more than l l l
l l l l l is l more than l l l l	l l l l l l is l l more than l l l l
l l l l is l l l more than l	l l l l l is l l l l more than l
l l l l l is l l l more than l l	l l l l l l is l l l l more than l l
l l l l l l is l l l more than l l l	l l l l l l is l l l l l more than l
l is l less than l l	l is l l less than l l l
l l is l less than l l l	l l is l l less than l l l l
l l l is l less than l l l l	l l l is l l less than l l l l l
l l l l is l less than l l l l l	l l l l is l l less than l l l l l l
l l l l l is l less than l l l l l l	l is l l l l less than l l l l l
l is l l l less than l l l l	l is l l l l l less than l l l l l l
l l is l l l less than l l l l l	l is l l l l less than l l l l l
l l l is l l l less than l l l l l l	

B.—With Figures.

a. Writing of figures, thus: 2=| |; 3=| | |; 6=| | | | | |.
b. Forwards: 1, 2, 3, 4, 5, 6.
c. Backwards: 6, 5, 4, 3, 2, 1.

d.—Addition.

1+1	1+2	1+3	1+4	1+5
2+1	2+2	2+3	2+4	
3+1	3+2	3+3		
4+1	4+2			
5+1				

e.—Subtraction.

1—1	2—2	3—3	4—4	6—6
2—1	3—2	4—3	5—4	
3—1	4—2	5—3	6—4	
4—1	5—2	6—3		
5—1	6—2			
6—1				

f.—Analysis.

6=1+1+1+1+1+1	6=3+2+1
6=2+1+1+1+1	6=3+3
6=2+2+1+1	6=4+1+1
6=2+2+2	6=4+2
6=3+1+1+1	6=5+1

g.—Multiplication.

1×1	1×2	1×3	1×4
2×1	2×2	2×3	1×5
3×1	3×2		1×6
4×1			
5×1			
6×1			

h.—Division.

2÷2	3÷3	4÷4	5÷5	6÷6
3÷2	4÷3	5÷4	6÷5	
4÷2	5÷3	6÷4		
5÷2	6÷3			
6÷2				

i.—Comparison.

6 is 1 more than 5	1 is 5 less than 6
6 is 2 more than 4	2 is 4 less than 6
6 is 3 more than 3	3 is 3 less than 6
6 is 4 more than 2	4 is 2 less than 6
6 is 5 more than 1	5 is 1 less than 6

Of course, all these examples are to be given promiscuously as well as in regular order.

The work thus begun in the first school year is continued through the second school year. The exercises for every number from ten to twenty-five must be similar to those given above for the numbers two and six. Still, it may be of service to give another example. Let us take the number nineteen. To save time, the mental exercises (A. of the number two) are left out, it being understood that every operation must be introduced and illustrated by means of the things which the pupil sees about him.

Premising, therefore, that the following exercises have been properly introduced and illustrated by mental exercises; and secondly, that all the slate and blackboard exercises—which here are only indicated by figures—are performed first by means of straight lines, dots, crosses, and other marks, and then with figures, as illustrated in the case of the number six, in the preceding division, we have the following exercises for the number nineteen:

1. *Composing or making the number.*—By means of the balls of the

abacus, marbles, pencils, sticks, or marks on the blackboard, the child has learned that the number nineteen is composed of nineteen ones or units, or of one ten and nine ones or units:

(*a.*) 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1=19 units.

(*b.*) 1 1 1 1 1 1 1 1 1 1+1 ten.
1 1 1 1 1 1 1 1 1+9 units.

(*c.*) 10+1 1 1 1 1 1 1 1 1

(*d.*) 10+9, or 19.

2.—*Counting Forwards and Backwards.*

Forwards from 1 to 19; 2 to 19; 3 to 19, etc.
Backwards from 19 to 1; 19 to 2; 19 to 3.
Regularly and promiscuously.

3.—*Addition.*

(*a*) $1 + 1, 2 + 1, 3 + 1$ to $18 + 1$.
$1 + 2, 2 + 2, 3 + 2$ to $17 + 2$.
$1 + 3, 2 + 3, 3 + 3$ to $16 + 3$.
to
$18 + 1$.
} Regularly and promiscuously.

(*b*) $1 + 2, 2 + 2, 3 + 2$ to $1 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2$; or, instead of being written in a line, the figures may be placed under each other.
$1 + 3, 2 + 3, 3 + 3$ to $1 + 3 + 3 + 3 + 3 + 3 + 3$. In a line and under each other.
$1 + 4, 2 + 4, 3 + 4, 4 + 4$ to $1 + 4 + 4 + 4 + 4$. In a line and under each other.
$1 + 5, 2 + 5, 3 + 5$, etc., to $5 + 5 + 5$; $14 + 5$ to $9 + 9$.
(*c*) Any addition of numbers, the sum not to exceed 19.
e. g. $1 + 3 + 5 + 2 + 7 + 1 = 19$; or 1
3
5
2
7
1
—

4.—*Analysis.*

(*a*) 19 is composed of 19 ones or units.
$19 = 10 + 9$; $15 + 4$; $16 + 3$, etc.
(*b*) $19 = 1$ ten and 9 ones are units.

5.—*Subtraction.*

(*a*) $1 - 1$ to $19 - 1$; $2 - 2$ to $19 - 2$; $3 - 3$ to $19 - 3$; so on up to $19 - 19$.

(*b*) $19 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 + 1$;
$19 - 3 - 3 - 3 - 3 - 3 - 3 + 1$;
$19 - 4 - 4 - 4 - 4 + 3$;
Up to $19 - 9 - 9 + 1$.
(*c*) $19 - 1 - 7 - 3 - 2 - 6 + 0$, etc.

6.—*Comparison of Numbers.*

19 is 9 more than 10, etc.

7.—*Addition and Subtraction.*

e. g. $6 + 8 - 7$; $16 - 4 + 7$; $(8 + 4 + 7) - (3 + 2 + 1)$; etc.

8.—*Multiplication.*

(*a*) $1 \times 1, 2 \times 1$ to 19×1; $1 \times 2, 2 \times 2$ to 9×2; $1 \times 3, 2 \times 3$ to 6×3; so on up to 9×2.
(*b*) $2 \times 2 \times 2 \times 2$; $3 \times 2 \times 2$; $4 \times 2 \times 2$.
$3 \times 3 \times 2$; $2 \times 3 \times 3$; $3 \times 2 \times 3$; $4 \times 4 \times 1$.
$2 \times 4 \times 2$; $2 \times 2 \times 4$.

9.—*Addition, Subtraction, and Multiplication.*

e. g. $(3 \times 4) - 6$; $(2 \times 5) + 8$; $(6 + 3) \times 2$; $(4-3) \times 16$.
$6 + 8-7 \times 2$; $(3 \times 4)-(6 \times 2) + 7-3-3\times 2$;
$(4 \times 2)-(2 + 4)+(3 \times 5)$, etc.

10.—*Division.*

(*a*) $19 \div 2$, by 3, by 4, up to $19 \div 19$.
(*b*) Give all numbers which are divisible by 2, 3, 4, 5, 6, 7, 8, 9, without a remainder.
(*c*) How many times are 2, 3, and to 9, contained in 19; can be taken from 19, etc?

11.—*Miscellaneous Exercises.*

$8+4=$	$3+3+3-8$	$2\times3\times3$
$7+5+6=$	$12\div6$	$4\times3\times1$
$19-4=$	$17\div4$	$16\div8$
$19-9=$	$16-12$	$18\div9$
$3\times6=$	$2\times2\times2$	
$16\div4=$	$17-9+9=$	
$5+9-7=$	$9+9-11=$	

How many times can we take 4 from 19?
How often is 5 contained in 19?
Take twice 2, 4, 6, 1, 3, 5, 7, 9, 8.
Add 2 to 2 so many times till the sum is 14, 18, etc.

Every number from ten to twenty-five is to be treated in the same manner as the number nineteen. But the numbers greater than twenty-five become too unwieldy, so to say, to be thus treated. The child having had abundant practice in comparing one number after another with its preceding ones in all imaginable ways, in regard to addition, sub-

traction, multiplication, and division, is prepared to take a forward step. In order to prepare the way for this forward step, the child must have clear and ready perception of numbers from ten to one hundred. To this, it is necessary that the child understands clearly the following principles of notation:

11=10+1, *i. e.* 1 ten and one unit; 12=10+2, etc., to 19=10+9.
20=2 tens.
21 to 29=2 tens (or twenty)+1, 2, etc.
30=3 tens.
31 to 39=3 tens (or thirty)+1, 2, etc.
90=9 tens.
91 to 99=9 tens (or ninety)+1, 2, etc.
100=10 tens.

The child will soon learn; first, that but ten Arabic characters are used in notation; second, that of these only nine have a value of their own, an absolute value; third, that tens occupy the second place and units the first; fourth, that it always takes *ten* units to make *one* ten, or in general, that it takes ten of a lower order to make one of the next higher order. But great care must be taken not to make these exercises too technical. The abacus, or dots, or other marks arranged on a chart or on the blackboard in a tabular form, must convey clearly to the mind of the child the fact that ninety are nine *tens;* that nine are nine *units;* that the difference between ninety and nine is that in the former number we have nine *tens*, in the latter nine *ones* or *units*. Thereupon we may draw out the fact that in order to write ninety, we must write nine in the second place, and have some figure to the *right* of it, and that nine standing alone, or to the *right* of some other figure, is always *nine, i. e.*, nine *units*.

The child having obtained clear perceptions of the numeration of tens, the same work must be performed upon them, which, in the fourth division of this grade, was performed upon units; but with this difference, that while we add tens to tens, and subtract tens from tens, we multiply or divide tens by units, only. Let us take as an example, the number sixty, or six tens.

The following tables indicate the written exercises to be performed on the slate and blackboard. *Abundant mental or concrete examples must introduce and illustrate every step.* All the work must be performed with straight lines and other marks, and with figures.

A.—WITH STRAIGHT LINES, ETC.

1.—*Composing or making the number.*

l l l l l l l l l l=1 ten
l l l l l l l l l l=1 ten
l l l l l l l l l l=1 ten
l l l l l l l l l l=1 ten
l l l l l l l l l l=1 ten
l l l l l l l l l l=1 ten.

The number is composed of six tens—*i. e.*, of six groups, each of which contains ten units.

2.—*Counting forward and backwards.*

l l l l l l l l l l, 1 ten or ten; l l l l l l l l l l / l l l l l l l l l l, 2 tens or twenty; so on up to 6 tens or sixty.

Forwards and backwards.

[In the following tables 10 indicates always a group of ten straight marks, as in 1 and 2, and teachers must write out in full what, for convenience sake, is only indicated below.]

3.—*Addition.*

10 + 10
10.10 + 10
10.10.10 + 10
10.10.10.10 + 10
10.10.10.10.10 + 10, etc. See page 46*, where substitute ten straight lines for every one straight line.

4.—*Analysis.*

10.10.10.10.10.10 = 10 + 10 + 10 + 10 + 10 + 10, etc. See page 47*, and observe directions given under *Addition.*

5.—*Subtraction.*

10 — 10
10.10 — 10, etc. See page 47*, and observe directions given under 3 and 4.

6.—*Comparison.*

10.10 is more than 10; *i. e*, 2 tens is 1 ten more than 1 ten, etc. See page 48*, and follow directions given above under 3, 4, and 5.

7.—*Multiplication.*

10 × 1, *i. e.*, one times ten; one times two tens, etc. See page 48*, and in the multiplicands substitute tens for the units, but the multiplier must remain units. Thus, the last example will be six times one ten is six tens or sixty.

8.—*Division.*

10.10 ÷ 2, *i. e.*, two tens or twenty, divided by two, gives 1 ten or ten; three tens, or thirty, divided by two, gives one ten or ten, remainder one ten, etc. See page 48*, and in the dividends substitute tens for the units; but leave the divisors unchanged; *i. e.*, let them remain *units.*

B.—WITH FIGURES.

The work is the same as given on page 48*, except that for 1, 2, 3, 4, 5, and 6, wherever occurring, we substitute 10, 20, 30, 40, 50, and 60, respectively; except that in multiplication the multiplier remains 1, 2, 3, 4, 5, and 6, respectively; and in division the divisor remains 1, 2, 3, 4, 5, and 6, respectively.

The work for the third school year is as follows:

I. Exercise in notation and numeration of numbers to 1,000. Teachers must always bear in mind that to lay a good foundation thorough work is necessary; and that in instructing primary grades, constant resort to objects is imperative. To teach notation and numeration objectively we must teach, by means of objects, that integral numbers are formed by continually adding one to the preceding number; that we divide numbers into orders, and that *ten* of a lower order make *one* of the next higher order. Objects should be arranged into groups of ten each; ten such groups into a larger group to form a hundred; ten of this second class of groups [units are illustrated by individual objects, and form the first order; the first *grouping* occurs in forming tens when ten individuals are collected into one group, a ten,] into a still larger group to form a thousand. In this and the preceding division the pupils may be profitably employed in writing on each of ten slips of paper or pasteboard, furnished by the teacher, ten or ten times ten straight lines, or crosses, or dots, etc. Each pupil of the third division will thus be supplied with *ten tens;* and if he is required to divide three tens or thirty into two equal parts, he soon sees that one ten falls to each part, and that one ten remains, which cannot be divided as a *ten.* In the second division, each pupil will have *ten hundreds.* It is, perhaps, best to let no slip contain more than ten marks, and to have a sufficient number of slips to give a thousand marks.

II. Exercises, mental and written, in addition, subtraction, multiplication, and division of numbers within 100, the sum or product in no case to exceed 100. In addition, subtraction, and multiplication, the units to be added, subtracted, or multiplied first, then the tens; principles of carrying forward and borrowing illustrated. In division, the tens to be divided first, then the units. Multiplier and divisor not to exceed nine.

In other words, the exercises which were heretofore performed upon units and tens separately, are now to be performed upon units and tens combined. The method of teaching this is so obvious that we shall simply indicate the steps.

1.—*Addition.*

(*a*) Add numbers consisting of tens only to numbers consisting of both tens and units: 20 to 45; 30 to 65; etc. Here the tens alone are increased. (*b*) Add numbers consisting of tens and units to numbers consisting of tens only: 45 to 20; 65 to 30; etc. (*c*) Add numbers consisting of tens and units to each other: (1) 23 to 45, etc.; the sum of the units does not exceed nine; (2) 47 to 53; 65 to 27, etc., where the sum of the units exceeds ten, in which case the tens resulting from the addition of the units are *carried forward* to the tens—that is, the sum of the tens is derived (1) by the addition of the tens, to which add (2) the tens resulting from the addition of the units. The child will easily see the convenience of adding the units first, carrying forward the tens, if any, resulting from their addition; and then adding the tens, including the tens, if any, carried forward from the units. The examples should at first consist of two numbers only, but afterwards may consist of several numbers, in which case they must be placed under each other, units under units, tens under tens, but the sum must never exceed 100.

In adding columns of figures, the pupils must be trained to give only results at each step.

5
9
3
1
6
7
—

Improper.—Seven and six are thirteen, thirteen and one are fourteen, etc.

Proper.—Seven, thirteen, fourteen, seventeen, etc.

2.—*Subtraction.*

(*a*) Minuend consists of tens and units, subtrahend of tens only; 45—30, etc. (*b*) Minuend and subtrahend consists of tens and units; units of the subtrahend not exceeding the units of the minuend: 68—41, 75—55, etc. (*c*) Minuend consists of tens only; subtrahend of tens and units: 80—41; 50—43; etc. Principle of borrowing illustrated. (*d*) Minuend and subtrahend consists of tens and units, the units of subtrahend exceeding the units of the minuend: 45—38; 62—29, etc. Principle of borrowing illustrated.

3.—*Multiplication.*

(*a*) Multiplication table to 10×10. Children must construct their own tables. Children must be able to prove that 5×7 are 35; that $9 \times 6 = 54$.

7		5	9		6
7		5	9		6
7		5	9		6
7	or	5	9	or	6
7		5	9		6
		5	9		6
		5			6
					6
					6
$7 \times 5 = 35$		$5 \times 7 = 35$	$9 \times 6 = 54$		$6 \times 9 = 54$

(*b*) Multiplicand contains tens only. Multiplier not to exceed nine: 30×3, etc. Solution: 3 times 3 tens are 9 tens, or ninety; just as 3 times 3 horses are 9 horses, etc. To introduce short multiplication, it may be advisable to treat these examples also as follows: $30 \times 3 = 3$ times 0 units are 0 units; 3 times 3 tens are 9 tens, etc.

(*c*) Multiplicand consists of tens and units; multiplier not to exceed nine. (1.) Product of units does not exceed nine: 42×2; 31×3, etc. Illustrate as follows:

42	31, etc.
42	31
—	31
84	—
	93

$42 \times 2 = 2$ times 2 units are 4 units; write the 4 units; 3 times 4 tens are 8 tens; write the 8 tens, etc.

(2) Product of units exceeds nine: 25×4, 15×5, 26×3, etc. Illustrate as follows:

```
 25    15    26
 25    15    26
 25    15    26
 25    15
       15
 ---   ---   ---
100    75    78
```

15 ÷ 5 = 5 times 5 units are 25 units, or 2 tens and 5 units; write the 5 units, and add the 2 tens to 5 times 1 ten, etc.

Teachers must remember that the product is not to exceed 100. All examples in multiplication will therefore be found within the following limits:

50×2, or 2×50;	14×7, or 7×14;
33×3, or 3×33;	12×8, or 8×12;
25×4, or 4×25;	11×9, or 9×11;
20×5, or 5×20;	10×10.
16×6, or 6×16;	

4.—*Division.*

(*a*) Division tables to $100 \div 10$. Children must construct their own tables.

(*b*) Dividend contains tens only, exactly divisible by the divisor, which does not exceed 9: $60 \div 2$, $80 \div 4$. Solution: 6 tens divided by 2 gives 3 tens, or thirty, etc. To introduce short division, it will be advisable to treat these examples also as follows: $60 \div 2 =$, 6 tens divided by 2 give 3 tens, or thirty; 0 units divided by 2 give 0 units, etc.

(*c*) Dividend consists of tens only, not exactly divisible by the divisor, which does not exceed 9: $30 \div 2$, $60 \div 3$, etc. Proceed as follows: 3 tens divided by 2 give 1 ten, leaving 1 ten undivided, which cannot be divided as a ten, but may be divided as 10 units, etc.

```
30 ÷ 2 = 10
20        5
--       --
10       15
10
--       etc.
```

(*d*) Dividend consists of tens and units, each exactly divisible by the divisor, which does not exceed 9: $63 \div 3$, etc. Proceed as follows: 6 tens divided by 3 give 2 tens; 3 units divided by 3 give 1 unit, etc.

```
63 ÷ 3 = 20
60        1
--       --
 3       21
 3
--
```

(*e*) Dividend consists of tens and units, tens not exactly divisible by the divisor, which does not exceed 9. The whole dividend (1) exactly divisible, (2) not exactly divisible.

$45 \div 3 =$ 4 tens divided by 3 give 1 ten; write 1 ten; 1 ten and 5 units, or 15 units, remain to be divided; 15 units divided by 3 give 5 units, etc.


```
45 ÷ 3 = 10        97 ÷ 4 = 20
 3        5        80        4
--       --        --       --
15       15        17       24 and 1 remainder.
15                 16
--                 --
                    1
```

III. Ideas of vulgar fractions to be developed; notations of same to be taught to ninths. Same operations upon these fractions as upon integrals from 1 to 10 in the fourth division of this grade.

The manner of developing the ideas of vulgar fractions is obvious, and we shall not waste space and time to give any illustrations. We call the attention of teachers to the necessity of teaching the subject by means of *objects*.

In regard to the operations to be performed upon them, every teacher can easily prove his own examples. The examples given on page 48* will serve as guides. Instead of having 6 units, we have $\frac{6}{7}$ or $\frac{6}{8}$, as the case may be, and we perform upon these $\frac{6}{7}$, etc., the operations indicated on page 48*. To illustrate:

(*a*) Composing the number: $\frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2} = \frac{6}{2}$
(*b*) Counting forwards and backwards: $\frac{1}{2}, \frac{2}{2}, \frac{3}{2}$, etc.
(*c*) Addition: $\frac{1}{2}+\frac{1}{2}=\frac{2}{2}$; $\frac{2}{2}+\frac{1}{2}=\frac{3}{2}$, etc.
(*d*) Subtraction: $\frac{1}{2}-\frac{1}{2}=\frac{0}{2}$; $\frac{2}{2}-\frac{1}{2}=\frac{1}{2}$, etc.
(*e*) Multiplication: 1 times $\frac{1}{2}=\frac{1}{2}$; 3 times $\frac{2}{2}=\frac{6}{2}$, etc.
(*f*) Division: $\frac{6}{2}\div 2=\frac{3}{2}$, etc.
(*g*) Analysis: $\frac{6}{2}=\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}$.

The following fractions are to be treated in the above manner:
$\frac{1}{2}, \frac{2}{2}$, $\frac{1}{3}$ to $\frac{3}{3}$; $\frac{1}{4}$ to $\frac{4}{4}$, etc., to $\frac{9}{9}$.

IV. After the numeration and notation of 100's has been learned, the 100's are to be added, subtracted, multiplied, and divided, in a similar manner as the 10's were added, etc., in the preceding division. By substituting 100's for the 1's, on page 48*, the teacher will have a full schedule of the work. See, also, the remarks relating to 10's, page 54*.

8.—GEOGRAPHY.

In Geography, *Monteith's Introductory Geography* has been discontinued, and the use of a text-book is not allowed until in the fifth school year. A thorough course in Local Geography has been substituted for the memorizing of the text-book which usually constitutes studying of Geography. To show the scope of the geographical instruction required by the revised course, several extracts are given from an article entitled *Guides for Instructions in Local Geography*, published in the *California Teacher* for February, March, and April, 1873:

I.—GENERAL LOCAL GEOGRAPHY.

(*a.*) *Idea conveyed by the term "Local Geography," or Geography of Home.* The first thing in sketching a plan for teaching local geography, or the geography of home, is to determine what we mean by *our home*. Let us

then ask what is generally understood by this expression? I am at home in the house where I live, in comparison with other houses; at home in the city or town which contains my dwelling house, in comparison with other cities or towns; at home in the scenes to which my eyes are accustomed, in comparison with strange scenes; at home in the land of my birth, in comparison with foreign lands; finally, at home on the earth, in comparison with other heavenly bodies, and only really first at home in the life beyond, in comparison with our pilgrimage on earth. Thus we see how variable may be the extent of this idea, how little and how much it may convey. But for our purpose a definite extent and definite limits are absolutely necessary. We shall, therefore, agree to understand by the term home the place where we live and the scenery within our vision (without taking in points of great distance); the study of what lies within these limits is called *Local Geography.*

(*b.*) *Purpose of the study of Local Geography, and its relations to other Studies.*—The aim of this branch of instruction is then to give a knowledge of home. But here again we must be more exact, for how much may be comprised in the term *knowledge of home!* It comprises the visible phenomena of the heavens and of the atmosphere, the face and nature of the soil, also, its irrigation; still further, the native animals, plants, and minerals; the artificial productions of its inhabitants; their dwellings and principal occupations; their social and foreign relations (the latter being generally expressed by trade and its channels); and, finally, the history of the place. Of course it is easy to see that all these subjects cannot be exhaustively treated in this branch of instruction; that would be the work of a lifetime, and more; think for a moment merely of the native plants and animals, and the historical part. Such is not to be the task of the instructor in local geography; to speak figuratively, he is not to count the stones in the streets, nor the shingles and slates on the roof; he has, rather, only to teach what would be found in *any* good geography of any country, province, or district. We should therein find mention of the natural and artificial productions, and of the history of the land, but only of the most important and characteristic, together with one or more marked peculiarities; but we should find no complete enumeration, description, or representation of these. The instruction of *local* geography must be the same; here, also, mention is only to be made of the most important and most striking natural productions, omitting all details; here, too, we should find something of history, but only of those events and occurrences of which the place mentioned has been the scene.

But has, then, the geography of a country nothing to do with the sun, moon, stars, and storms? By no means, although this belongs to general geography. This speaks of the revolution of the earth on its axis; of its relation to the other heavenly bodies, particularly to the sun; of climate and seasons; and for this division of general geography, observation of the native skies and of the atmosphere, may be a preparation. Thus local geography is essentially of a *geographical* nature, and, as such, is to be especially preparatory to future geographical studies.

Local geography also prepares and places in your hand other branches of instruction; for instance, as already mentioned, *the natural sciences,* in giving the names and localities of certain plants, animals, etc.; *natural philosophy,* in taking notice of common natural phenomena to be observed by the eye; history, in looking back into the past.

Local geography is also very important in teaching the command of *language,* inasmuch as the teacher should insist upon the correct, clear, and complete expression of what has been clearly comprehended. It also affords abundant material for short *written* exercises. It even touches upon *mathematics,* since, now and again, there are distances to be measured and counted, if only by steps.

Finally, I would mention *drawing* as another branch which local geography uses as her hand-maid in the representation of different geographical forms, in turn serving her again by thus training hand and eye for the study of drawing.

(*c.*) *Art and Manner of Instructing.*—Local geography is an integral part of sense-perception, or object teaching, and, as such, should be commenced with the child's first entrance into school. The purpose of object teaching is to lead children to observe and to describe objects seen; it is to practice the senses of the child in correct perception and conception, and for this purpose, different objects are selected for the child to examine. It also introduces subjects and phenomena which cannot be directly produced before him, but which the child has already perceived, or can perceive outside the school-room; in a word, phenomena lying within the sphere of the child's life. In this way the child attains to a conscious knowledge of various perceptions already made by him, and these become regulated and raised to the rank of distinct ideas. But here the teacher has to guard against proposing too much to himself, since, although the child *might* have seen a great deal, there is perhaps much that he has not methodically observed, or that he has even not seen at all.

Hence we see that the principal aim of sense-perception teaching is of a methodical nature; it is to exercise the senses and to cultivate the power of observation. But as the cultivation of this power takes place by means of material substances, it therefore does not exclude, but includes the material plastic elements, namely: knowledge in regard to the phenomena considered. It is, at the same time, from these single building stones, collected one by one, that we are more easily enabled to build up later, the mental structure, the idea of home. And the "mentalizing," if I may be permitted the word, of surrounding phenomena peculiar to our home, the combining of them into one total image, is properly the final aim of this instruction. This we might call the top round of the ladder, and I would place it in the third school year, designating it by the name, Exclusive Local Geography. As on the lower round of the ladder *method* took preëminence, so, on the upper round it is to *material* that preëminence is to be given.

But yet the province of local geography proper is to take up within itself the normal aim of sense-perception teaching, and, at the same time, to continue in a certain direction beyond the limits of this aim. Its province is less to communicate and to teach, than so to guide through continual observation and examination, as to enable the pupils to acquire for themselves the desired knowledge. But there is much besides which must be given to the child; for instance, the historical part. Moreover, the mental vision will also be carried beyond the visible local boundaries, as in irrigation, natural or artificial, and here again *communication* of knowledge is indicated.

But I am wandering from my subject, which was the art and manner of instruction in local geography. Let us take the nearest way thereto.

Teaching of local geography is not easy. On the part of the teacher it requires skillful preparation, great circumspection and patience; on the part of the pupil, open eyes and close observation, even outside the school-room. Moreover, properly studied, it requires many excursions

outside the walls of the school-house, since, as many of the objects cannot be brought into the school-room, we must, therefore, seek them where they are situated.

Again, the pupil is to be energetic and persistent in searching out and observing for himself alone, this or that object. In this direction there are many well-adapted exercises, of which I shall point out but a few:

1. Exercises in *observation;* for example, the direction of a weather-vane.
2. Exercises in *examination;* for example, the different statues in a city.
3. Exercises in *discovery;* for example, where there are reservoirs in a city, or springs or brooks in a country place; on what buildings there are weather-vanes, and what they look like.
4. Exercises in *measuring* and *counting;* for example, to measure by steps the length of a street, or width of a road, comparing distances thus measured between any two places.

These and similar problems the pupil can work out for himself, and thereby he is forced to be observing and attentive when the teacher is not by him.

It is best to give exercises of this kind directly before the conversational lesson on the selected subject, so that the pupil may come prepared beforehand.

What means of aid have you in local geography teaching, and how do you use them? Perhaps a plenty of charts and maps. But these are the very aids which are most likely to be misused. For example, it is a misuse of them when they are used from the commencement, and when instead of the actual locality only a picture of it is viewed, so that the scholar becomes less acquainted with the locality itself than with the map of it. One cannot be too strongly warned against this danger. Let this be your ruling principle: *First the object, then the picture,* so that the object will explain the picture, and not the picture the object. These auxiliary means mentioned should only be used after the perception has been gained from the reality, and after the scholar himself has drawn little sketches of it. He gains, too, so much the more pleasure from seeing, instead of his own imperfect attempt, something more perfect. In this way he comes to a right understanding of geographical maps in general, which is a great point gained for his future geographical studies.

I would also draw attention to another valuable auxiliary which, so far as I know, has never been called to aid. I mean photographs of the various important buildings, monuments, and statues of a city. Every child should procure the ones selected, and, after having seen the actual object, the photograph will be a material aid to his faculty of perception. Of course it would become a necessity that such photographs could be bought at a very low price.

Having given these general principles, I pass on to the treatment of the subject, dividing it into two parts, viz: the *primary steps* coming under the province of object teaching, and the *final steps* being Exclusive Local Geography. I have also to add that the primary steps can by no means be kept to any strict systematic order. The children have to observe separate objects as they present themselves; very often opportunity is given for comparison between two objects or phenomena. Nevertheless, although the children can follow no system in their observations, the teacher must have his own plan of instruction or he will soon find himself overwhelmed.

II.—SPECIAL LOCAL GEOGRAPHY.

Primary Steps in Local Geography, belonging to the department of sense-perception instruction.

The School-room.—(Terms of distinction—below, before, behind, right, left.) Four walls, one floor, one ceiling. The walls *stand*, the floor and ceiling *lie*—ceiling above, floor below. Right wall, left wall, front wall, back wall. Four corners. Of equal size are ceiling and floor; right wall and left wall; front wall and back wall. In which side are there windows? How many? In which doors? What stands on the floor of the school-room? What hangs on the walls? How long and how wide is the school-room? (To be measured by steps.) How many seats, desks, tables, stand in the room? (Drawing of the floor, or of one of the walls, on the blackboard, before the class.) Observation, description, and comparison of various things in the school-room. For example: of doors, windows, table, slate, chalk, sponge, etc. Make drawings of some of them. In observing the windows, the children are to look out and tell what they see.

The School-yard.—There is a yard to our school house. On which side or how many sides is it? It is wide and long. How long and how wide? (Measured by steps.) What surrounds it? What can you see standing or lying in the yard? What is the use of what you see? How do you go from the school-room into the yard? How many steps of stairs from the hall into the yard?

The Sun.—Does the sun shine to-day? Where is the sun? Does it always stand still in the same place? What does it do in the morning? In the evening? When is the sunshine warmest? How does the sun look? Does it shine every day? When does it shine? Where does it rise—set? Point where with your hand. Say aloud: morning, *east*—evening, *west*. Where is the sun at noon? Point where. We say that direction is towards the *south*. In what direction does the sun rise—set—stand at midday? The sun moves in the sky from east to west. It does not move in a straight line, but in a curved line. (Drawing.) The direction opposite south is called *north*. Repeat the four points of direction.

The Moon.—Can we see the sun in the sky at night? Then we see the moon and the stars. Do we see them every night? How does the moon look? Does the moon also give warmth? Does it also rise in the east and set in the west? (Told to look at it in the evening.) Comparison between the sun and the moon.

The Stars.—When do we see the stars? Can we see them every evening? Do they look as large as the sun or the moon? How many stars are there in the sky? Are they all equally bright? Do they give warmth like the sun? Are there stars in the sky by day also?

Water.—(For a rainy day.) Look out of doors. It is raining. The rain is water. It falls in drops. How many drops are there? Where do they come from? Do the drops always remain on the ground? The rain wets. What, for example? Does it rain every day? Has it rained much to-day? How long is it going to rain? Look into the street—yard. You see the water standing there in several places; those are puddles; we will see if they are still there this afternoon or to-morrow. They are there no longer; what has become of them? We also have water here in the room; what is it in? Who brought it? Where was it brought from? (Something more about the well, pump, or water-

pipes.) A glass filled with water. Properties of water observed: fluid, transparent, colorless, tasteless, odorless. Can the water be made warm or hot? How? Can't it also be made solid? What is it then called? When does water become ice? Water falls from the sky as rain; it rises out of the earth; but it also flows on the surface of the earth. Do you know any large body of water near us?

Clouds.—Look out of doors. What is the sky covered with? How do the clouds look? Are they solid? Towards what direction are they moving? When it rains, snows, or hails, are there always clouds in the sky? Rain does not fall from all clouds. What is the color of the clouds we now see? What other colors do we sometimes see in clouds? What colors do we usually see in the clouds at sunrise and sunset?

Wind.—How do we perceive the wind? Can we see it or hear it? What is the wind? Strike the air with your handkerchief, you feel a blowing—that is wind. East, north, south, west wind. What do we call a very strong wind?

Rainbows.—You see a rainbow in the skies. It is of different colored stripes. There are seven of these: a red, an orange, a yellow, a green, an indigo, and a violet stripe. The red is on one edge, the violet on the other edge, and the green in the middle of the rainbow. When our face is towards the rainbow, the sun is behind us. We can sometimes see the color of the rainbow in a water-bottle, in the water of a fountain, or in water falling over a mill-wheel. (The teacher will find it an advantage to have strips of paper of the seven colors, and exercise the children in arraying them in proper order; the child thus early acquires a correct knowledge of colors.)

The School House.—When possible, observe all four walls from without. How many windows? How many rows, one above the other? (Stories.) What is the shape of the windows? Of what are the walls made? The roof? How many chimneys? Is there a door in the side of the building? What else is there on this side? On which side does the sun shine in the morning? In the afternoon? On which side does it shine little, or not at all? East, west, north, south sides. What is within the school house? Hall, class-rooms, etc. How many class-rooms? Who can tell me of any other school house in the city or town?

Classes and Teachers in the School.—What is the name of our school? You are all in one class; which class is this? How many classes are there in the whole school? This room is our class-room. Is it on the ground floor or first story—in the second story, or third? Comparison may be made between the school house and some neighboring building.

The people who build houses, and what materials they must have.—In building a house, the following people work: masons, carpenters, locksmiths, glaziers, roofers, plasterers. What do masons do? The carpenters? etc. What do the masons use? The joiners? What parts of the house are built of stone? brick? wood?

Snowy Day in Winter.—Look out of doors. What is falling from the sky? That is snow, and we say it falls. Does the snow fall in drops, like water? It falls in flakes. It is white. It remains lying on the ground. When the weather becomes warmer the snow melts; then it becomes water. Why does it snow in Winter and not in Summer? What do boys do with snow? Can we ride on the snow? How can we ride on the snow?

Ice.—It is very cold out of doors; it has frozen. The water is covered with a sheet of ice. Does the ice fall from the sky, like snow? Why does not water become ice in Summer?

People who Furnish us with Food.—Butchers with meats, bakers with bread, millers with flour, gardeners with vegetables and fruit, grocers with sugar, salt, coffee, etc., fishermen with fish, brewers with beer, etc. Particulars in regard to each; for example, where does the butcher get his meat? From the animals that are slaughtered. What animals are slaughtered? Where are they slaughtered? Where in the city do we find meats for sale? Where are vegetables raised? Where sold? Name vegetables you have seen in the market. Conclusion: What food do we obtain from animals—what from plants?

People who Furnish us with Clothing.—Who provides you with your clothing? Do your parents make it themselves? Of whom do they get your clothing? To make clothing we must first have something of which to make it. Of what do we make clothing? In what kind of stores do we buy materials to make clothing? Name some of the stores. We can also buy many kinds of clothes ready-made; name such garments. Clothing must be kept clean; shirts, stockings, etc., often washed. Laundries.

Care of Health.—Who of you has ever been sick? Whom did your parents send for to make you well again? What did the doctor do when he came? Where did the doctor come from? Where is there an apothecary? When you were sick you staid in the house and your parents took care of you; but is there no place for people who are sick and have no home to stay in, and no one to take care of them? Have you ever seen a hospital? Where? Do you know of any other hospitals?

Trade.—Many people who buy things to sell, have stores; these people are called merchants, traders, storekeepers. Tell me some stores near where you live. (Signs, firms.) What do we buy in a grocery store? In a clothing store? To buy we must have money. Coins and paper money. (Show different coins.) Of what metals are coins made? What is the building called where money is made? Did you ever see a mint? Where? What kind of a building? What banks do. What brokers do.

Street where the school is situated.—On what street is our school? It is long and wide; how many steps wide? How long? Is it straight, or somewhat crooked? Is it level, or somewhat hilly? (The general direction in which it runs.) Is it planked or paved? How many stones does it take to pave a street? They cannot be counted. The middle of the street is higher than the sides; why? The water runs off in the gutters; does it run up or down? On both sides of the street are narrow walks for people; these are called sidewalks. In the streets we meet carriages, men, and animals; what kind of animals? On both sides of the street stand houses; there are two rows of them; see if there is anything else to be seen in the street. Posts—on top of the posts, lanterns—within the lanterns, lights. The streets are lighted at night; why? We find trap-doors of wood or iron in the streets; what are they? Conclusion: Ask individual scholars on what street they live, through what streets they come to school.

Different kinds of carriages seen on the streets.—Names of different vehicles. Difference between a car and a carriage. Name different parts of a carriage.

Public Squares or Parks.—Where is the nearest public square? How many steps long is it? What is in the square? What is it for? (Drawing.) Other squares or parks.

A Ranch or Farm.—A ranch or farm is a large place, and on it we find many things—wagons, wheelbarrows, plows, harrows. We also see

many animals—hens, ducks, geese, etc. There are also several buildings. There is a dwelling house; there is another building with large doors and no windows; that is a barn, where hay and grain are kept; sometimes there are places for the horses and cattle in the barn; sometimes there are sheds near for them. There are cows and calves, oxen, horses, and swine. What are all these animals for? The cows are to give milk, the horses to draw the wagon and the plow, the oxen and the swine to be fattened for slaughter. The oxen must also draw the plow, harrow, etc. There are also many people on a ranch—boys, girls, and laborers. What do they do? They have to feed the cattle, to milk the cows; (what is done with the milk, who takes care of it, and what we call the place where it is kept); they have to manure the fields, to plow the ground, to sow seed, to harvest, and thrash. We call such people *farmers*, and their work *farming* or *cultivating the soil*.

Fields.—Plow-land, tilled land, or fields is land that is plowed every year once or several times. The land is plowed with a plow; the plow cuts the surface of the earth into narrow strips and turns them over; the cuts or hollows made are called *furrows*. The earth must not only be plowed but harrowed also; the harrow covers the seed with earth, and breaks up the clods. The seed is sown either with the hand or with a sowing machine. The seed that is sown is not to lie in the earth, but to spring up, grow, and bear fruit. The field is manured in order to make the seed vigorous and healthy. Kinds of seed sown. Harvesting, season, and manure.

Neighboring Bodies of Water (*rivers, bays, lakes, etc.*), *Bridges, etc.* *A River*.—The *name*. The water of a river flows in a hollow channel of earth; and this hollow is called the *bed* of the river; the borders of this bed—that is, the land at each side of the river—are called the *banks* or *shores* of the river. The river is as *wide* as the distance from one of the banks to the other; if there is a bridge across the river we can tell how wide the river is by measuring the bridge. The river is also *deep* as well as wide; its depth is the distance from the surface of the water to the ground below. The ground at the bottom of the river is uneven, like the ground around us, so that in some places it comes nearer to the surface of the water than in other places; of course the water is not so deep in such places, and these are called *shallows* or *shallow water;* places where the water is so shallow that we can wade across or cross with a horse are called *fords*. Sometimes the bed of the river is so hilly that the top of these little hills rise above the surface of the water; these hill tops are entirely surrounded by water, and are called *islands*. A river has not always the same width and depth; when there is but little or no rain for a long time the river is narrow, more shallow, and the water more clear; in heavy rains or after heavy rains the river becomes swollen—that is, it becomes wider and deeper; it rises higher in its bed and the water becomes less clear. Sometimes the bed of the river becomes so full that it cannot contain all the water of the river; the water then rises above the banks and flows over the land; we then say the river has overflowed its banks, or has flooded the country. When the weather in Winter is cold enough, the surface of the water becomes frozen and forms ice; sometimes the ice is so thick that people can walk and skate upon it; sometimes the water freezes to so great a depth that the ice becomes thick and strong enough to bear heavy loaded teams. What kind of animals live in the river? What use do we make of the water in the river?

Shipping (*vessels and boats*).—There are several kinds of vessels in

which we can travel on the water. (Examples. A general description of the shape and different parts of a vessel, but no details.) People whose business it is to sail vessels on the water are called sailors, boatmen, etc. The forces which move vessels are the currents of water, steam, horses, wind, and the human hand. The means through which the forces work are steam engines, ropes, sails, masts. Different ways of traveling. Which is the easiest, quickest, slowest; why? Ships are usually loaded with different things, viz: wood, stone, coal, wheat, etc. This is called the *cargo* of the ship. A *wharf* is a place on the shore or bank of a body of water, to which vessels can be made fast, while they lade and unlade their cargoes. Places near the water where vessels are built or repaired are called *shipyards*.

Bridges (*railroad and river bridges*).—For what purpose are bridges? Of what built? Difference between a railroad bridge and one made for teams and foot passengers. How supported from below. How ships pass through a river bridge.

A Railroad.—A railroad is a road built of iron rails; there are two rows of these rails, and they are at all points equally distant; these two rows of iron rails are called the track. The carriages which roll on these tracks are called *cars;* several cars joined together are called a *train;* at the head of a train is a steam carriage, which we call the *locomotive*. The locomotive moves by means of steam from boiling water, and when the locomotive moves it draws the train with it. There are *passenger* trains and *freight* trains; express trains and accommodation trains. (Explain the difference.)

Journey on a Railroad.—Who of you has ever made a railroad journey? What railroads did you travel on? Let us imagine or play that we are going on such a journey. Some one may tell me what railroad we will go on. Way to the railroad station. Where? Buying tickets. Waiting in depot. Signal for taking our seats in the car. People whose business it is to take care of the train; conductor, brakeman, engineer, fireman; their duties. Signal for starting. Motion of train. First slow, gradually faster. How to stop train. Places where a train stops called *stations*.

Herewith I close the chapter on material for local geography in its primary steps, that is for the first two school years; I herein lay claim, however, neither to a complete selection of subjects, nor to an exhaustive treatment of them; I have rather sought to indicate the method of handling them. In regard to changes in the sky and atmosphere, I would add that these are not merely to be observed once but many times in the course, the time being selected according to the actual presence of the phenomena to be observed. In addition to the four main points of the compass, the second year may include four intermediate points, northeast, etc., observing the difference in direction, Summer and Winter, of the point of the sun's rising and setting.

III.—HIGHER LOCAL GEOGRAPHY.

By means of the preceding instruction in local geography the children have not only cultivated their faculty of sense-perception, but have also acquired a knowledge of many local facts and various phenomena. In accomplishing this no systematic method has been followed, but the

most favorable opportunities for observing separate phenomena, particularly such as are transitory and fleeting, have been improved. The seasons of the year have here greatly served as guides. Also, in groups of similar objects, one has been selected as a representative of all for observation and study; for example: one street, one public square, one church, one body of water, etc. In this way the child has been led to perceive and take cognizance of the essential characteristics of all such objects.

But, in its higher steps, local geography can no longer occupy itself with the consideration and description of single objects; it has rather to endeavor to bring to view order in the manifold and varied forms and phenomena in the world of home, by associating and grouping together things similar in nature. In no other way would it be possible to accomplish the final task of local geography, viz: to create a complete mental picture of the locality studied, and its various features and phenomena.

Hence it now follows that instruction in local geography, in its advanced steps, must follow a fixed system, which is quite foreign to the nature of sense-perception instruction. The reviewing in the third year of much which has come under notice in the primary steps of the study, will be but more conducive to the accomplishment of this purpose.

As an object of instruction, I should divide the subject into two parts:

1. Its changing and changeable phenomena, or the department of observation.

2. The fixed and unchangeable features, the department of consideration and reflection.

The two parts of the course of instruction do not succeed one another, but rather the first mingles itself incessantly with the second, in every season of the year. It comprises chiefly phenomena of the sun, moon, stars, and atmosphere. Let us draw nearer to this matter.

1. THE LOCALITY OF HOME IN ITS CHANGING PHENOMENA—DEPARTMENT OF OBSERVATION. (*a*.) *The Sun.*—In the heavens we see the sun by day, the moon and stars by night. Always? Do we not often see the moon by day also? These, together, are called the heavenly bodies. The sun appears to be the largest among them; it moves from east to west, in a curved line, bending towards the south. From morning to noon-day it ascends; from noon to evening it descends. The highest point reached is at noon. In the sunshine all non-transparent bodies throw a shadow. Observe the shadow of such a body—your arm, for instance—at morning, noon, and evening, taking notice of its direction and length. Result: the shadow always lies in the direction opposite to the sun—in the morning toward the west, at noon toward the north, at evening toward the east. It is smallest at mid-day, largest morning and evening. From morning to noon it decreases gradually in size—from noon to evening it increases. It describes a curve line from west to east, bending toward the north, in a manner directly opposite to that of the sun. Repeat these observations and descriptions frequently in the course of the year. At different times mark points of rising and setting of the sun; also, its height at mid-day. The days of Spring and Autumn, as well as of Summer and Winter, are not to be allowed to pass unnoticed. At last we shall reach this result: The sun does not always rise and set at the same points in the horizon. At the beginning of Spring and Autumn it may be said the sun rises exactly in the east, and sets exactly in the west; these points are to be marked—also the time of rising and setting. Till the beginning of Summer it rises and sets continually farther and farther toward the north. It also rises continually earlier and earlier, and sets later and later. At mid-day it ascends continually higher and higher—the shadow becomes shorter and shorter. The line it describes is always an increasing curve. From the twenty first of June all this is reversed. On that day the sun rises farthest at the northeast, and sets farthest at the northwest. That is the day of its earliest rising and latest setting; it noon of that day it reaches its highest point in the heavens; the shadow of the body is then smallest; the curve the sun describes in the heavens is the largest.

Continuing observations of this nature during the remaining part of the year, and especially at the beginning of Winter, similar facts will be developed in regard to the sun's rising and setting, the height and length of the curve it describes, length of shadow at noon-day, etc. The tropics can here be well explained. Difference of temperature at different parts of the day, and at different seasons of the year.

(*b*.) *The Moon.* (*c*.) Observation of the stars. (*d*.) Observation of weather.

2. THE LOCALITY OF HOME IN ITS UNCHANGEABLE FEATURES.—*Department of Consideration and Reflection.*—It is impossible to make the division of the phenomena to be observed entirely distinct; the department of reflection and consideration must comprise much that is not fixed and unchangeable; for instance, animated nature as represented in the animal kingdom. Life is motion, and all motion to be learned must be observed. Since, however, the animal kingdom in its motion and activity, and the vegetable kingdom in its development, belong to a fixed locality, we therefore, in this case, combine observation with consideration and reflection. For convenience we shall select San Francisco for illustration of this department.

(*a*.) *General View of San Francisco.*—The place where we reside, where our school house stands, is named San Francisco. San Francisco is called a city. A city is an incorporated town governed by a Mayor and a Board of Supervisors or City Council. San Francisco is situated on the west side of San Francisco Bay; directly opposite on the eastern shore is Oakland; San Francisco also lies on the southern shore of the Golden Gate; Saucelito is situated on an inlet of the opposite northern shore, and lies a little west of north from San Francisco.

(*b*.) *Streets.*—The city contains many streets. Each of you may tell me the name of some street. Market street is one of the longest and widest; its commencement is at the water's edge, about two thirds of the distance from Meiggs Wharf to Rincon Point; from there it extends in a straight line, its direction being northeast and southwest. Most of the streets lying north of Market street run at right angles to each other, their direction being nearly north and south, east and west; south of the line of Market street, the streets run in various directions and at various angles. Market street is one of the business streets of the city. Let us see how many different kinds of business located on Market street you can mention to me. What public building? What other large buildings? Van Ness Avenue is also a very wide street. It commences at Market street and extends to the water's edge, which it reaches in the vicinity of Black Point. Van Ness Avenue runs north and south, and Market street northeast and southeast; it therefore lies in a diagonal line to Market street. Does it then form a right angle with Market street? Does it run parallel to Market street? Can you tell me what kind of buildings we find on Van Ness Avenue? Is it a business street?

Point Lobos Avenue is another very wide street; it commences at Laurel Hill Cemetery, or Lone Mountain, and extends in a westward direction to the Pacific Ocean, which it reaches just south of Point Lobos; Point Lobos forms the southwestern boundary of the Golden Gate. Point Lobos Avenue runs in an easterly and westerly direction; is it then parallel to Van Ness Avenue? To Market street? How many of you have been on Point Lobos Avenue? Did you see as many business places as on Market street? As many private residences as on Van Ness Avenue? Did you meet any heavily loaded business teams? What rocks are in the Pacific Ocean opposite the end of this road? What animals live on these rocks? Front street, Battery street, Sansome street, Montgomery street, and Kearny street, all run from Market street north towards the water, in the direction of North Point near Meiggs Wharf; they all run in a northerly and southerly direction; (drawing) the lines which separate them are parallel lines, and hence we say these streets are parallel to each other. Each of you may tell me of some place of business on either of these streets. Are these business streets? Each scholar should give the name of the street on which he lives, and the directions in which it extends. Also, the direction at twelve o'clock M. of the shadows in any given street; if they fall in the same direction as the street, then the latter must extend north and south; if, on the contrary, they fall upon one side, then the street extends rather in an easterly and westerly direction; very narrow streets extending in the latter direction will lie wholly in shadow at noonday. The chief aim of this exercise is to enable the learners, wherever they may be, to recognize the cardinal points. There are so many streets in the city that we cannot name them all; some are long, some short; some wide, some narrow; some straight, some crooked; some are called places, courts, or alleys; these are generally shorter and narrower than most of the streets, and some are closed at one end. What can you tell of the different kinds of paving with which the streets are covered? Of what use is it to pave the streets? At night the streets are lighted with gas; where does the gas come from? In Summer some of the streets are watered; why?

(*d.*) *Sketching of a Map of San Francisco.*—The pupils have already been required to draw simple maps, representing the location of the school house, of their own homes, and of public squares, and other places in the city. They have observed that in every drawing of a map, south has always been opposite to north, east to west. Their maps should always be made with a cross indicating the four points of the compass; when drawing upon the blackboard, however, it is well to exercise them in varying the direction of the cardinal points; for example, while one has north indicated by the top of the blackboard, the next one may have it represented at the right, the next one at the lower part of the blackboard, the next one at the left, and others may represent it at points diagonal to these; this, however, must not be done till after they have had sufficient practice not to become confused in the general rule that, on maps, north is represented by the upper part, south by the lower part, east by the right, and west by the left. The following method of sketching a map of San Francisco is given to illustrate the general plan, and is by no means offered as the best plan of arrangement. First, draw a cross representing the four cardinal points. In the middle of the quarter which represents the northeastern part of the space allotted to the whole map, draw a dotted line from northeast to southwest; as Market street runs a little east of northeast, and a little west of southwest, draw another line intersecting these at very acute angles; now erase the first line and leave the second line to represent Market street. In the middle of this line make a large dot to represent the new City Hall; now draw a small right-angled triangle at the north of Market street, making the dot the center of the hypothenuse; the streets drawn may now be named, and the City Hall Park thus bounded: on the north by McAllister street, on the northeast by Jones street, southeast by Market street, west by Larkin street. Larkin street may now be extended northwards, its northern end indicating the vicinity of Black Point. Continue Jones street in a line parallel to Larkin street, the two intermediate parallel streets being indicated by lines, and their names learned. Now, extend Hayes street in a westward direction from the southwestern angle of City Hall Park. Next, draw Van Ness Avenue a little to the west of Larkin street, and parallel with it, beginning at Market street, crossing Hayes street at right angles, and terminating it also in the vicinity of Black Point. Passing westward at a right angle from Van Ness Avenue we come to Park Avenue, which leads to the parallelogram representing Golden Gate Park. A little north of the western end of the park we find the Cliff House and Seal Rock; a little further north, Point Lobos. North of Park Avenue we will locate the Masonic, Odd Fellows', Calvary, and Laurel Hill Cemeteries. Fort Point a little further north than Black Point, northwest from Laurel Hill Cemetery, and northeast from Point Lobos; directly south of Fort Point is the Presidio. Let us now return to the Cliff House, and ride along the beach till we come to the Ocean House road; this road runs nearly east from the beach until we have gone some ways beyond the Ocean House, it then turns to the southeast till it brings us to the Industrial School; here the San José Railroad, coming from the south, crosses this road opposite the Industrial School, and here we will take the cars, and wind along in a northeasterly direction till we reach the San José depot on Market street; this depot is but a little distance southwest of the junction of Van Ness Avenue and Market street. On our way in the cars, when we had rode about one third of the distance, we passed St. Mary's College at the left and east of the road; at about three fourths of the distance rode in the cars, we passed the Jewish Cemetery at the left and east of the road; and half way between the Jewish Cemetery and the Market street depot was the old Mission Church—this church is also half way between the railroad on the east and Market street on the west. We will now locate the Almshouse by drawing a straight line northwards from the Industrial School to the eastern end of the Golden Gate Park, and on this line, half way between the Industrial School and the Golden Gate Park, we will make the site of the Almshouse. We will next locate the County Hospital, which lies in a nearly easterly line from the Almshouse, east, also, of the San José Railroad. Let us now return to the junction of Jones and Market streets, the northeast boundary of City Hall Park. Continuing our way through Market street in a northeasterly direction, after passing six blocks, we come to the first large business street that runs north and south; this is Kearny street, and we will represent it by a line running parallel to Van Ness Avenue, Jones, and Larkin streets. Kearny street is a long thoroughfare, and we will walk along it the distance of eleven blocks, when we find the street crossed at right angles by Broadway, which runs east and west; turning to our left we see the City and County Jail, on the north side of Broadway, a little distance from Kearny. Now, locate and name streets east of Kearny, and parallel to

it. Locate and bound principal public squares. Names, in their order, of the streets between Kearny and Van Ness Avenue, etc. The location of school houses should have been noted as soon as it could be indicated by the outlines drawn; each child should also be required to locate his own residence on the map drawn by him. Of course, each teacher will select additional points of importance, guided, somewhat, by the degree of interest this or that place may have for this or that class. Any map of San Francisco may be used as a first guide and aid in these lessons.

(*e.*) *Water used in our homes and in the city.* (*f.*) *Buildings in the city.* (*g.*) *Manufactories.* (*h.*) *Churches.* (*i.*) *School houses.* (*j.*) *The Fire Department.*

(*k.*) *Inhabitants of a City.*—1. Animals.—There are many people dwelling in a city, but, besides these are also many animals. Let us first speak of the latter. Many of these are of use to man; they are sheltered, fed, and cared for by man; such are called domestic animals. Here mention of some is to be made and some questions in regard to their form and appearance; then questions like the following: What people use horses? For what do they use them? In the city we see many horses but few oxen, cows, calves, swine, or poultry; all the latter we usually find in greater numbers outside of the city. There may be many oxen, calves, and swine, and much poultry brought into the city, but only to be slaughtered. Name different domestic animals and the special use to which each is put. Some animals are also merely for our amusement; for example, some kinds of dogs, birds, as canaries, parrots, mocking-birds, etc.; also, gold-fishes. There are places of amusement for the public, called zoölogical gardens; these contain a collection of a great variety of animals. Who of you have ever been in such a garden? Name some of the animals you saw. Many of these are brought from foreign lands; the men who take care of them are called their *keepers*, and they feed the animals and take care of them. These animals are kept, not for mere pleasure, but also that we may see and learn about the animals of foreign lands. There are also many animals at large in the city who find food and shelter for themselves; for instance, birds, rats, mice, flies, etc. 2. *People Dwelling in the City.*—The most important inhabitants of a city, however, are the *people* who dwell in it. In San Francisco, in eighteen hundred and seventy-two, there were one hundred and seventy-eight thousand two hundred and seventy-six inhabitants; of these, five thousand were what is called a floating population, that is, they have no permanent homes in the city, but live in hotels, hospitals, almshouses, etc.—or they call San Francisco their home, but spend most of their time making short voyages along the coast, bay, or rivers. Counting the number of people in the city, county, country, etc., is called "taking the census." This is a very old custom among nations, for we read in the Bible that the ancient Hebrews and their families were numbered by sex and age; and the most ancient record of a census that we possess is the enumeration, by Moses, of the people in the wilderness. The inhabitants of a place differ in age, wealth, religion, etc. According to age, they are divided into adults, and those who have not yet reached the age of eighteen or twenty-one years. Are you an adult? In regard to wealth, we find people of every degree, from extreme and helpless poverty to immense wealth. The rich have to help provide for the poor; this they do partly by the taxes which they pay to the Government, partly by establishing charitable and other societies, and also in more direct ways. When you no longer go to school, each

of you will find something to do among your fellow men; for instance, what will *you* do? and you? etc. Thus each of you will follow some calling, that is, some pursuit, business, or profession—a certain department of labor, by which you will support yourselves and acquire property. The wealth which one possesses is called his property. Some of you will become farmers; where will those live and what will they do? Some will become mechanics; tell me some things which a mechanic makes. Some will be manufacturers; how many kinds of manufactories can you name? There are also many tradesmen or merchants, who buy and sell various kinds of wares and goods. A trader or merchant usually has on the outer wall of his store a sign, on which is his name and the kind of goods he buys and sells; often two or more persons unite in some business; this is called a partnership, and their names together is called the name of the firm or house. Merchants have others to assist them, and these are called clerks, bookkeepers, cashiers, etc. A city where there are many merchants is called a commercial city; where there are many manufactories, a manufacturing city. Besides mechanics and merchants, there are also many other people—painters, musicians, singers, physicians, municipal officers, clergymen, lawyers, teachers, etc. Many people work the whole year in the streets; these are coachmen, teamsters, and other drivers, etc.; others work in gardens, and are called gardeners; and still others work on the water, as fishermen, boatmen, etc. All the kinds of business we have mentioned are usually followed only by men. Women also have to work to support themselves and to acquire property; let us see how many kinds of business are usually followed by women. The inhabitants of a city also differ in religion; there are Protestants, Catholics, and Hebrews, or Jews. These different churches have schools, to which children go once a week; what are such schools called? Are the pupils taught the same things that they learn in their day schools? Some of these churches have day schools also for children; can you tell me where there is one such school? Besides the inhabitants who have their home in any certain place, there are also people who come to that place to remain for a short time, sometimes for business and sometimes for pleasure; what accommodations are provided for these people, whom we call travelers? Let us name several hotels, and tell on what streets they are situated.

3. *Relation of individual municipalities to the whole country.*—As the different classes in a building constitute together one school, so a city and the surrounding towns and country constitute a county; many counties are united in one State; many States united form our country. For the government of every *city* there is a Mayor and Common Council, Board of Aldermen or Supervisors; of every *State* there is a Governor and Legislature; of the *country* the President and Congress. These officers are chosen from among the people once in a certain number of years. The Mayor of a city dwells in the city; the Governor of a State in the capital city of that State; the President of the country at the National Capital. Who is the Mayor of our city? For how long is the Mayor elected? When was the present Mayor elected? When will his term of office expire? What city is the capital of the State in which we live? Who is President of our country? For how many years is the President elected? When was our President elected? When does his term of office expire? What city is the National Capital? Where is it situated? How far and in what direction from us? For the government and good order of cities, counties, States, and country, much

money is needed; this money is furnished by *taxes*, which are paid to the government by the people; the rich have to pay large taxes, while the poor have but small taxes to pay.

The fourth or fifth steps introductory to the study of general geography, treat of the history of the county or city, and then of the State.

[Translated from the German, by Mrs. Lane.]

SENSE-PERCEPTION; OR, OBJECT TEACHING.

To please those who would fain refrain from entering on their labor without some more extended classification, I will here attempt to illustrate a method founded upon a somewhat systematic basis. I would, however, first remark:

1. Concerning the amount of the following material, to many it may seem insufficient for one year, to others an overwhelming amount for that period. Who would be able to fix a limit suited to all?

2. In regard to some simple objects made of a single material, I have only given hints, which are by no means intended to exhaust the subject; they are but the key with which the teacher is to find and arrange his own material.

3. To the young teacher about to commence his first course of sense-perception teaching, I would recommend, nay, I would beg of him, to furnish himself with a manuscript book, and this by no means a thin one, to crease or rule every leaf in the middle, and on the one half to write out a preparatory exercise on every separate object, leaving the other half for future additions. The lesson itself may furnish additional material, for the thoughts and remarks of the children often furnish the most valuable matter. We are the teachers of children, but often they are also ours.

4. Do you find the lesson you have prepared too short, review or commence on the next; if too long divide it, and continue the subject in the following lesson.

In the following pages I give a few examples of what is to be considered and somewhat of the principle of classification to be applied in regard to the different objects; remarking that these are not complete preparations, but are, and should be, only sketches.

The chief division for the first series is: I. The human body. II. Its needs. III. The child as scholar. IV. The school-room. V. The school-house. VI. The sitting-room at home. VII. The sleeping-room at home. VIII. The kitchen. IX. Dwelling-houses. X. Other houses. XI. Country, town, and city. XII. City or town in which the children live.

I. The Human Body.—Its name: body. Parts: head, trunk, limbs. Number of parts: one head, one trunk, four limbs. Which parts of the body are double? arms, legs, hands, feet. Material: bones, flesh, blood; hard, soft, and fluid parts. Position of head, trunk, limbs. Changes in the body: growth, sickness, fatigue, heat, cold, injuries, death.

Animals also have bodies. What animal has a small body? what one a large body? what one a long body? what one a thick body?

1. The Head.—Form: round. Position: on the trunk. Parts: fore-

head, back, top, crown, face. Natural covering: hair. Baldness: little babies, old men. What men and boys wear on head: hats, caps. Hats and caps made of: straw, silk, felt, fur, cloth. What women and girls wear on their heads: bonnets, hats, caps, nets, ribbons, wreaths, flowers. Motions of head: nod, bow, shake, turn, hold upright. Headache. Heads of animals.

2. The Trunk.—Position: below head, above limbs. Parts: chest, abdomen, back. Limbs attached to trunk: legs, arms. Relative position of parts: abdomen below breast, etc. Motions of body: bend, turn. Dress: shirt, pants, vest, coat, jacket, uniform, overcoat. Condition: stout, thin, slender, crooked (humpback). Rules: bathe, wash.

3. The Limbs.—Name: arms, legs. Position: arms above and on each side; legs below and near together. Number: two legs, two arms. Dress: same as trunk. Number of parts of body: of which parts have we one? of which two? of which ten? of which too many to count?

4. The Hair.—Place. Color: black, white, brown, blond, reddish, grey. Kinds: smooth, bristly, curly. Length: long, half long, short. Purpose: warmth, ornament. What is done to the hair: comb, brush, cut, oil, curl, braid, coil, etc.; difference in youth and age. What is made of hair: rings, brooches, chains. Beard: mustache, side-whiskers, full beard. Rules: comb, brush, keep clean; not let hang in eyes, not pull other's hair. What animals are covered with hair?

5. The Ears.—Place: each side of head. Parts: external or outer, internal or inner. Number. Use: to hear. What we hear with them: (names of different sounds), singing, speaking, music, rustling, rattling, thunder, ringing of bells, clapping, cracking, rolling, etc. What causes these sounds? What sounds do we like to hear? What do we not like to hear? What injures the hearing? explosions, blows. Deafness. Wax of the ear: its purpose. Ornaments for the ears; rings (gold, jet, pearls, etc.) Rules: keep clean. How? with what?

6. The Face.—Place: it forms the front part of the head. Parts: brow or forehead, nose, eyes, temples, cheeks, mouth, chin. Relative position of these parts: above, below, between. Color: red, white, pale, (negro, chimney sweep, etc.) Other appearances: swollen, thin, sunken, smooth, bearded. Youth: full, rosy. Age: pale, wrinkled, haggard. Motions: laugh, weep, look joyful, angry, ashamed, friendly, sullen. Rules: wash; not cut, make grimaces, nor to be vain of a pretty face. Disfigured by: small-pox, burns, cuts.

7. The Forehead.—Place. Material: bone, skin. Surrounded by: hair, temples, eyes, nose. Youth: smooth. Age: wrinkled. Motions: wrinkle, frown, or scowl. Rules: keep clear and unclouded.

8. The Eyes.—Place: below—at both sides. Number: two; right, left. Parts: eyebrows, eyelids, eyelashes, eyeball. Use of different parts: eyebrows (color) to protect from perspiration—ornament; eyelids to protect from dust and other things—to make more safe in sleep; to clean the eye frequently, as we wipe the window glass; eyelashes, to shut more closely, to protect. Seeing. What do we see? form, size, color, motion, nearness, or distance of things. Forms seen: round, angular, long, short, broad, narrow, sharp, dull, smooth, rough. Sizes seen: large, small. Colors: green, red, etc. Motions seen: running, jumping, hopping, swimming, flying, turning, trembling, riding, etc. What things are near? far? (Diminution of size according to distance.) Motions of eye: open, close, wink, turn, roll, stare, squint. Aids to eye:

spectacles, opera-glass, spy-glasses. Blindness. Tears: whence do they come? when shed? (joy, grief.) Rules: keep clean; not look at dazzling light (sun, fire); not read with dim light; not hold book too near.

9. The Nose.—Place: below, above, between. Form: straight, crooked, short. Parts: ridge, point or end, bridge, nostrils. Use: breathe, smell. What we like to smell: flowers, food, fruit, perfumes. What we do not like to smell: decayed fruit, spoiled eggs, decayed meat, dead animals. Ornaments: rings (savages). Nosebleed. Rules: hand or handkerchief before it when you sneeze; keep clean; always carry handkerchief; not snuffle; always breathe through nose when possible.

10. The Mouth.—Place: below, above. Parts: lips (upper and under), teeth, tongue, gums. Color: red. Use: speak, eat, whistle, breathe, sing. Motions: open, close, distort. Rules: wash out; keep closed; not distort; not bite or draw in lips. Different names for different animals: beak, bill, snout, muzzle. What animals have a beak, etc.

11. The Teeth.—Place: in mouth; upper jaw, lower jaw. Number: twenty-eight to thirty-two. Kinds: incisors or cutting teeth, canine or tearing teeth, molars or grinding teeth. Color: white; diseased teeth: yellow, brown, black. Functions: biting, holding fast, chattering, grinding. Use: to chew, talk, ornament. Youth: complete, white. Age: fallen out, hollow. Toothache. Extracting teeth. Artificial teeth. Rules: brush, wash, bite no hard substance, not eat too many sweets, not pick with needles or pins.

12. The Tongue.—Place: in mouth. Form: long, thick. Color, red; (fever, white coating.) Motions: very mobile; can be stretched, shortened, drawn back, laid at top of mouth, arched, rolled. Use: to speak, whistle, taste. Rules: not to smack, not to run out of the mouth. Bible—The tongue is a little member, etc.; swearing, praying, praising, abuse.

13. The Neck.—Place: between. Characteristics: thin, thick, short, long. Use: to support the head; contains the trachea or windpipe, and the œsophagus or gullet. Motions: turn, bend backwards and forwards. Dress: scarfs, cravats, collars, ruffles, chains, ribbons. Rules: not wrap too much around it; not dress it too tight; wash; not bend too far backwards. Necks of geese, horses, swine, etc.

14. The Chest.—What are the principal parts of the trunk of the body? Parts of the chest: ribs, heart, pit of stomach. Motions: heave, sink, expand, contract, beating of heart. Rules: not dress too tight; upright position in standing, walking, sitting—throw chest forward.

15. The Hands.—Left, right. Parts: wrist, palm, fingers. Number. Parts of the finger. Only two thumbs. Nails: number. Use: ornament, protection, defense, scratching. Rules: pare or cut, not bite off; not scratch others with them.

Purpose of the entire hand: to eat, wash, dress, defend, work, etc. What kind of work? file, bore, plane, hammer, cut, sew, etc. Defense without weapons: to push, strike, seize, hold fast, strangle. Fists. Defense with weapons: sticks, clubs, swords, daggers, pistols, etc. Artistic accomplishments: perform music, drum, write, draw, paint, embroider, engrave. Dress: gloves. Rules: keep clean, not to play with in the school-room. Monkeys and apes have also arms and hands.

16. The Legs.—Right, left. Number. Parts: thigh, knee, lower leg, calf, ankle, foot. Motions: extend, draw up, lift, bend, stoop. Uses: to stand, walk, run, skip, jump, dance, climb, swim. What people make great use of their legs in doing their work? Organ players, letter-carriers, soldiers. Changes of condition: fatigue, lameness. Rules: not to be foolishly bold in jumping. Broken legs. What animals have two legs? four? six? eight? more than eight? What objects without life also have legs?—tables, chairs, etc.

17. The Foot.—Number: right, left. Parts: ankle, heel, sole, toes (ten). Compare toes with fingers. Uses: to stamp (same as of legs). Dress: stockings, shoes, slippers, boots, spurs, skates. Rules: turn outwards in walking, not sprain by leaping, not tread too heavily in the house, not tread on worms under your feet.

II.—NEEDS OF THE BODY.

I. Food.—(a) Food from flour: bread, cake, crackers. (b) Food from animals—Meat: beef from cows, pork from swine, veal from calves, lamb and mutton from sheep, venison from deer, etc. Birds: geese, ducks, chickens, pigeons, turkeys, larks, quails, etc. Fish: oysters, crabs, salmon, smelts, etc. (c) Food from fruits: cherries, berries (name kinds), peaches, plums, apricots, grapes, figs, pears, apples, nuts. (d) Food from roots: potatoes, carrots, turnips, radishes, onions, beets. (e) Food from leaves: salad, cabbage, parsley, etc.

Different ways of preparing feed—eaten raw, viz: cucumbers, salad, fruit; cooked, viz: meat, vegetables, fruit, etc.; roasted or baked, viz: meats, fruit, etc.; smoked: meat; preserved: fish, fruit, vegetables. Rules: do not eat too much; do not drop any pieces or crumbs; divide with the hungry; feed birds. Famine.

II. Drinks.—Kinds of drink. (a) According to temperature: cold, warm, hot. (b) According to taste: tasteless (water), sweet, sour, bitter (medicine), pleasant, unpleasant. (c) According to color—colorless: water; yellow: wine; white: milk; red: wine; brown: beer, coffee. What do we drink cold? warm? hot? What kinds of dishes do we drink from? cups, goblets, glasses. Thirst, great suffering. Rules: not to drink when very warm; not to take too much strong drink. Drunkards.

III. Sleep.—What we observe in a sleeping person: eyes closed, lies motionless, only the chest moves (why), conscious of nothing, breathes. When people sleep: at night; little children, sick people, old people: day and night. Where people sleep: in sleeping-rooms, on stacks of hay, on the ground, in tents (travelers, soldiers, shepherds, etc.) Purpose of sleep: rest, strength. Rules: not sleep too long (sluggards), not have to be called twice to get up; not forget to say prayers; lay your clothes in order when you undress; say "Good night" to father, mother, and all others. Dreams.

IV. Clothing.—What kinds of clothing we wear; review of lessons on head, trunk, feet, etc. What people work to make our clothes: tailors, shoemakers, cloth weavers, stocking makers, hat, cap, and glove makers, milliners, dressmakers, seamstresses, etc. Where we get the material to make our clothes—from the vegetable kingdom: cotton, flax; from the animal kingdom: wool from sheep, fur from wild animals, hair from the goat, silk from silkworm; from the mineral kingdom: iron, steel, brass, silver, gold. Material for cool clothing; for warm clothing; colors. Places to keep clothes: closets, wardrobes, trunks, bureaus, valises. Old clothes. Use of rags. Rules: keep clothing clean (brush, beat); keep it mended; give to the poor what you no longer need.

III.—THE CHILD AS SCHOLAR.

Where are you? in school. When do you come to school? in the morning. At what time in the morning? When do you go home? in the afternoon. At what o'clock in the afternoon? How many hours do you stay in school every day? What days of the week is there no school? Then how many days in the week is there school? What do you come to school for? to learn. To learn what? reading, writing, singing, etc. Who teaches you these? What are you, of his? Whose pupil (scholar) are you? Conclusion: every child that goes to school is a scholar. What are the scholars in the other classes? boys, girls, older, younger. How many scholars are in your class? How can we divide them? large, small; older, younger; good, naughty; industrious, idle; neat, untidy; punctual, tardy; obedient, disobedient.

Duties of the Scholar.—(*a*) At home before starting for school: get up in season; say prayers; comb hair; dress carefully; sharpen pencils; put together all the things needed to carry to school; bid "Good morning." (*b*) On the way to school: not loiter; not be noisy; not stop on the way; greet acquaintances. When to say "Good morning;" when "Good evening;" when to take off caps. Look out for horses and teams. (*c*) Coming to school: be punctual; take seat quietly. With what to be busy: reading, writing, drawing. What not to do: make noise, jump over the seats, stand on the desks, tease others. (*d*) During lessons: sit straight, be attentive, look at the teacher, observe, answer. How: loudly, distinctly, completely. Not prompt or tell others; not be uneasy, disturb others, play, or look around the room. (*e*) Going home from school: same as going to school.

In the same way and according to the plan given above, let the following subjects be taken up: slates; writing materials in general; slate pencils; rulers; inkstand; abacus; reading-book.

IV.—THE SCHOOL-ROOM.

Comparison with rooms at home: blackboards and seats; teacher's desk; place to hang clothing; stove, door, windows, ceiling, floor. Why things are placed in a certain way in the school-room. Compare two children, two caps, two books, two slates; a writing-book and a reading-book, pencil and pen, slate and blackboard, inkstand and goblet.

Hats and Caps.—Purpose: protect, cover, ornament the head. Parts: rim, crown, lining. Age: new, old. What we can do with them: put on, take off, hang up, lay down, lift up, brush, clean. Where, now: on desk, in hand, etc. They cost money; they can be bought. The wind can blow them away. When the hat is to be put on; when taken off. Color, material, price, manufacture.

V. The school-house. VI. Dwelling-rooms: tables, chairs, sofas, bureaus, mirrors, clocks, curtains, pictures, flower-pots, vases, etc. VII. Bed, wash-table. VIII. Kitchen; fuel.

Fire.—Where have you ever seen fire? in stove, grate, lamp, tobacco-pipe, cigar, houses burning, bonfires. How is fire produced? by people rubbing together pieces of wood; by steel, stone, tinder, matches, burning-glasses; without aid of people, by lightning, etc. (*a*) Use of fire: for warming hands, clothes, rooms, dishes; for cooking food, drinks, etc.; for drying clothes, boots, etc.; for melting wax, lead, tin, iron, copper, gold; for forging iron, copper; for lighting rooms, halls, stairways, streets, public squares, clocks, lighthouses, illuminations. (*b*) Harm that fire can do: burn directly, as food when cooking; burn by the blaze of a lamp or candle; by heated objects, as water, iron, etc. We can burn our fingers, hands, feet, gums, hair. What can be burnt by fires? houses, forests, trees, ships, clothing, wood-piles. How do fires originate? without blame, by lightning; through carelessness, with hot ashes, matches, lamps, gunpowder; through wickedness, in setting fires.

IX. Dwelling-Houses. X. Other Houses.—Comparison between dwelling-houses and churches; barns and sheds for cattle, etc.

XI. County, Town, City.—Houses: different ways in which they are built; situation, surroundings; gardens; roads or streets; public buildings; inhabitants, and their occupations.

XII. City or Town in or near which the Children Live.—Name, location (mountain, valley, river, etc.), size, surroundings, parts or divisions (if any), principal streets, public parks or squares, gardens, etc. Public buildings: churches, school houses, town house, city hall, court house, theaters. Inhabitants in general: general classes; poor, rich; ladies, gentlemen; well, sick; children, grown people. Inhabitants in special classes: those who furnish us with food, clothing, dwellings, tableware, furniture, amusements, health, safety, education, convenience, burial.

Occupations: further particulars in answer to three general questions, viz: what is done, what material, what tools; for example—

The Mason.—What does he build? walls, chimneys, houses, bridges, vaults, etc. What material does he use? stone, bricks, lime, mortar, water, etc. What tools does he use? hammer, trowel, pick, plumb, level, square, etc.

Dwellings.—Carpenter, locksmith, glazier, roofer, painter, stonecutter, plasterer, paperhanger.

Food.—Baker, butcher, gardener, poulterer, fisherman, hunter, confectioner, cook.

Clothing.—Tailor, shoemaker, hatter, weaver, tanner, furrier, buttonmaker, milliner, seamstress.

Tableware and Furniture.—Silversmiths, glassworkers, glassblowers, glasscutters, potters, tinmen, cabinetmakers, upholsterers.

Amusements.—Actors, singers, dancers, rope-dancers, artists, photographers. (Of course the three questions named cannot be invariably applied).

Health.—Physician, surgeon, apothecary.

Safety.—Soldiers, police, night-watchmen, chimneysweeps.

Education.—Clergy, teachers, booksellers, librarians, authors, printers.

Convenience.—Car-drivers, servants, street-laborers, letter-carriers, newspaper-carriers, vegetable dealers, etc.

Burial.—Sexton, grave-diggers.

A few miscellaneous subjects, selected from convenience and easy adaptation to short, concise lessons, may be found among the following:

A watch chain: material, color, links; use, to hold watch secure; where made, maker, price; what can be done with it, polished, washed, broken, fastened, loosened, lost, sold, exchanged. Kinds: (*a*) according to material: gold, silver, wire, steel, hair, silk, etc. (*b*) According to length: long, short. (*c*) According to strength: strong, thin, fine. (*d*) According to weight: light, heavy. Age: old, new. Price: dear,

cheap. Other chains: wagon chains, ship chains, etc.; use of each. Watch key, watch seal. Comparison of two or more chains.

A button: form, parts, materials, color, use, maker. What changes can happen to it? What can be done with it? Where can it be sewed? Comparison of different buttons.

A ball: form (other things of same shape), color, material, fitting, use; where to be thrown; how thrown; when not to be thrown; rules; price.

A needle: kinds, color, parts; use of different parts; what is to be sewed with it? maker, price; rules: not to put in mouth; not to pick teeth with; put away carefully; find when lost; pick up pieces when broken; (stories of injuries received from carelessness with needles). Same exercise on pins; compare needle and pin; pin has head, needle none; needle has eye, pin none; pin flexible, needle brittle; pin to make fast, needle to sew with.

A lamp: kind; different kinds; different uses; parts; material; burning material; color, maker, use; when to be lighted, when extinguished; changes; what to be done with it, what not to be done with it; illuminations; lamp manufactories; chandeliers; lanterns.

THE EARTH.—What have I here? some earth. Where else can you see earth? in flower-pots, gardens, streets or roads, fields, mountains, etc. Color of earth: gray, yellowish, reddish, brown, black. Kinds: fertile, sterile; sandy, stony, clayey, limey, marshy; forest, garden, field. Names of collections of earth; clods, garden beds, furrows, mounds, banks; hills, mounds, mountains, valleys. What can be done to it? hoed, dug, sifted, heaped up, plowed, harrowed, rolled, manured (different articles used to enrich land). What does the earth produce? plants. Name some. Which grow without labor of man? Which grow by labor of man? What does man do to cause the earth to produce plants? 1. He sows seeds in the earth. (*a*) Who? gardener, farmer, forester. (*b*) What kinds of seeds? (*aa*) The gardener sows flower seeds and vegetable seeds. (*bb*) The farmer sows wheat, corn, potatoes, etc. (*cc*) The forester, seeds of trees. When? generally in Spring; also, in Autumn, and in some countries in Winter. 2. He plants the earth; what does he plant? What does the earth need in order to be fertile? light, heat, rain, sunshine, wind, storm, cold, and snow. Tools used to cultivate the earth: spades, rakes, hoes, watering pots, plows, harrows, rollers, sowing machines, reaping machines, etc.

In conclusion, I would say that the foregoing is offered as a model of the plan, rather than the forms of expression to be used; I have aimed at brevity of phrase. Also, these exercises, intended to be oral, for the smallest children, may serve well as the groundwork for short written exercises in the higher classes.

[Written for the California Teacher, by H. N. Bolander.]

BOTANY FOR SCHOOLS.

The following series of illustrated articles is well calculated to serve as an introduction to the systematic study of Botany. The illustrations, as well as the language used here, are, in the main, taken from Dr. John Lindley's Letters on Botany to a Lady. The method pursued

by this distinguished botanist, about forty years ago, is essentially the same as now generally followed by great and distinguished educators. According to this method only a limited number of plants are studied, and but few technical terms are introduced. Agassiz, referring to this method in his "Methods of Study of Natural History," says the following: "The truth is, that to study a vast number of species without tracing the principles that combine them under more comprehensive groups, is only to burden the mind with disconnected facts, and more may be learned by a faithful and careful comparison of a few species than by a mere cursory examination of a greater number. When one considers the immence number of species already known, naturalists might well despair of becoming acquainted with them all were they not constructed on a few fundamental patterns, so that the study of one species teaches us a great deal for all the rest. De Candolle, who was at the same time a great botanist and a great teacher, said that he could undertake to illustrate the fundamental principles of his science with the aid of a dozen plants, judiciously selected, and that it was his unvarying practice to induce students to make a thorough study of a few minor groups of plants, in all their relations to one another, rather than to attempt to gain a superficial acquaintance with a large number of species."

The most discouraging parts of Botany to the new beginner consists either in the numerous new and strange names one has to learn the meaning of, or in the minuteness of the parts by which plants are distinguished from each other, or in the great multitude of species of which the vegetable kingdom consists; and it must be confessed that there is something seriously alarming in the mass of preliminary knowledge which it would appear has to be acquired before any perceptible progress can be made.

But if we look at the subject a little more closely we shall find that of the technical terms employed only a small number is really necessary in the beginning; that minute parts are little consulted in practice, however much they may be in theory; and that in consequence of the perfect arrangements of botanists, no more inconvenience is experienced from the number of species than in any other branch of natural history. There are certain terms, the exact meaning of which *must* be understood, and which cannot be dispensed with if the science is to be studied to any good purpose; a sort of habit of observation has also to be acquired, without which the differences between one plant and another can never be appreciated or remembered; but these things may be gained imperceptibly and without any extraordinary exertion, either of industry or patience. We have only to begin with the beginning, and never to take one step till that which precedes it is secured; afterwards the student may advance to what point he pleases. This appears to us the only secret in teaching Botany.

We must, however, be careful while we attempt to strip the study of its difficulties, that we do not also divest it of its interest, and imitate those who, by the ingenious substitution of words for ideas, have contrived to convert one of the most curious and interesting of all sciences into a meager and aimless system of names.

In strict accordance with this method, we proceed now to consider the floral parts of the Buttercup, and their relative position on the receptacle.

You need not to be told that plants have generally five very distinct parts, viz: ROOT, STEM, LEAF, FLOWER and FRUIT. The application of

the three first of these terms is already well known to you; the last is applied by botanists not only to such objects as apples, pears, cherries, and the like, but also to any part which contains the seed, so that the grains of corn, the heads of poppy, the nuts of the filbert, and even the little bodies which are commonly called caraways, are all different kinds of fruit.

It is in the flower that the beauty of plants chiefly resides. It is there that we find all the curious apparatus by means of which they are perpetuated, and it is the spot where the greatest number of parts are found, the names of which are unusual and require to be remembered. To illustrate these, let us take a very common plant, to be found everywhere, by the learned called *Ranunculus*, by the layman, Buttercup, or Crowfoot.

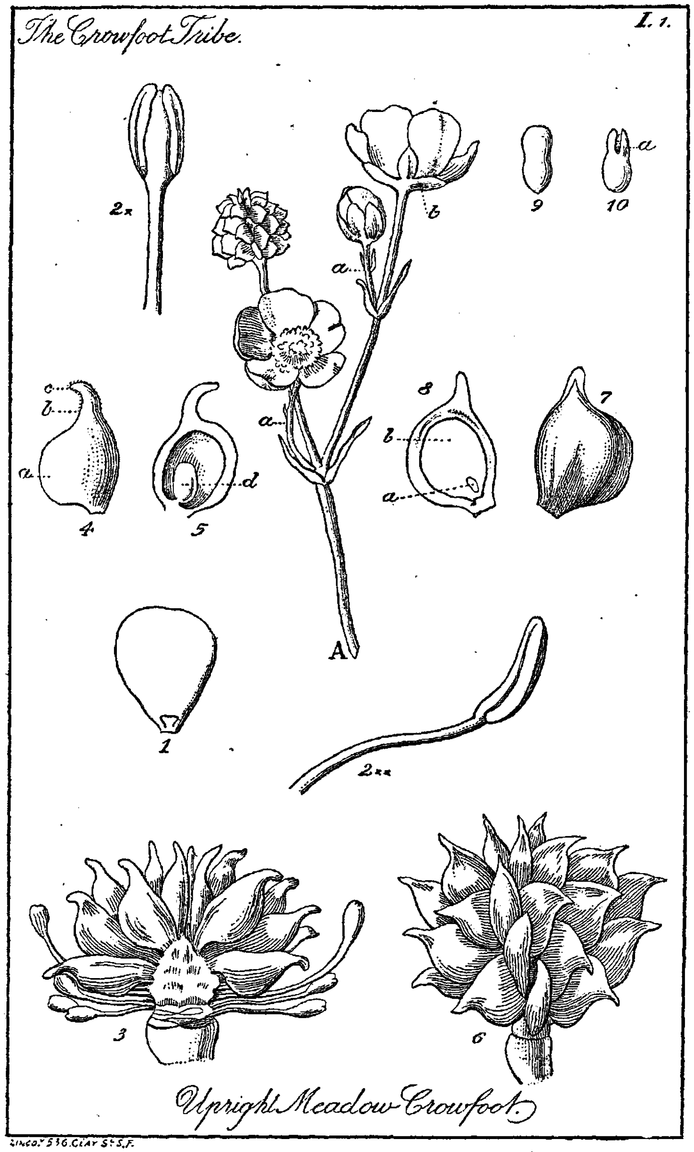
On the outside of the flower of this plant, about the middle of its stalk, are one or two little leaves, which look like the other leaves, only they are a great deal smaller; indeed they are so small as to resemble scales. These are the BRACTS.

Next them, and forming the external part of the flower itself, are five small greenish-yellow hairy leaves (*a*, *b*), which are rather concave, and fall off shortly after the flower opens. Leaves of this sort form the CALYX, and are called SEPALS; they protect the more tender parts of the flower.

Next the sepals are placed five other leaves, which are much larger and of a bright, shining yellow. They stand up and form a little cup, in the bottom of which the other parts of the flower are curiously arranged. These five shining leaves form the COROLLA, and are called PETALS. Their business is, in part, to prepare the honey which exudes from a little scale you will find on their inside, near their base (fig. 1), and which, if secreted in sufficient quantity, is collected by bees for their sweet food; and it is, in part, to protect from injury the delicate organs which lie in their bosom. These last are of two sorts, as you will soon learn.

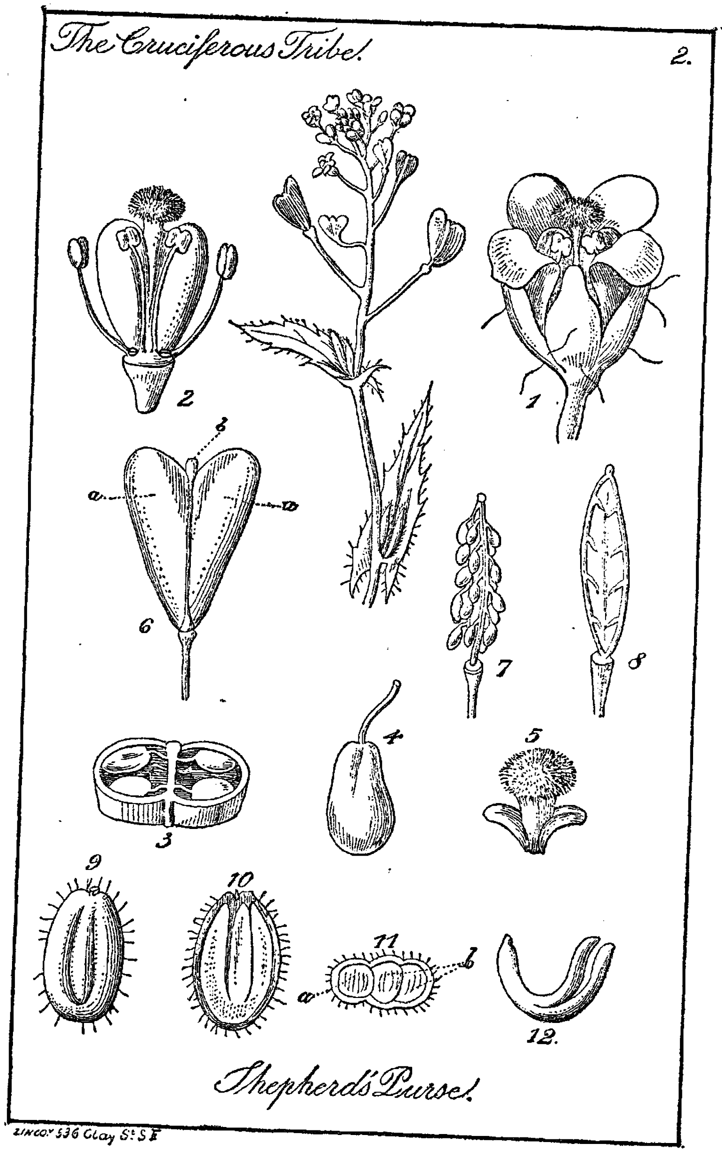
In a ring from which both the sepals and petals arise, you will find a number of thread-like yellow bodies, which are thicker at the top than at the bottom. They spread equally around the center, as if they wished to avoid that part, and are a great deal shorter than the petals; we call them STAMENS. Their lower part, which looks like a thread, is called the FILAMENT; their upper thickened end is named the ANTHER. This last part is hollow, and will be found, if you watch it, to discharge a small quantity of yellow powder, called the POLLEN. The pollen has a highly curious office to perform.

Next to the stamens, and occupying the very center of the flower, are a number of little green grains, which look almost like green scales. They are collected in a heap, and are seated upon a small elevated receptacle (figs. 3 and 6); we call the whole collection of them the PISTIL, and each separate one a CARPEL. They are too small to be readily seen without a magnifying glass; but if they are examined in that way, you will remark that each is roundish at the bottom, and gradually contracted into a kind of short, bent horn at the top; the rounded part (fig. 4, *a*) is the OVARY; the horn (*b*) is the STYLE; and the tip of the style (*c*), which is rather more shining and somewhat wider than the style itself, is named the STIGMA; so that a carpel consists of ovary, style, and stigma. At first sight you may take the carpels to be solid, and fancy them to be young seeds; but in both opinions you would be mistaken. The ovary of each carpel is hollow (fig. 5), and contains



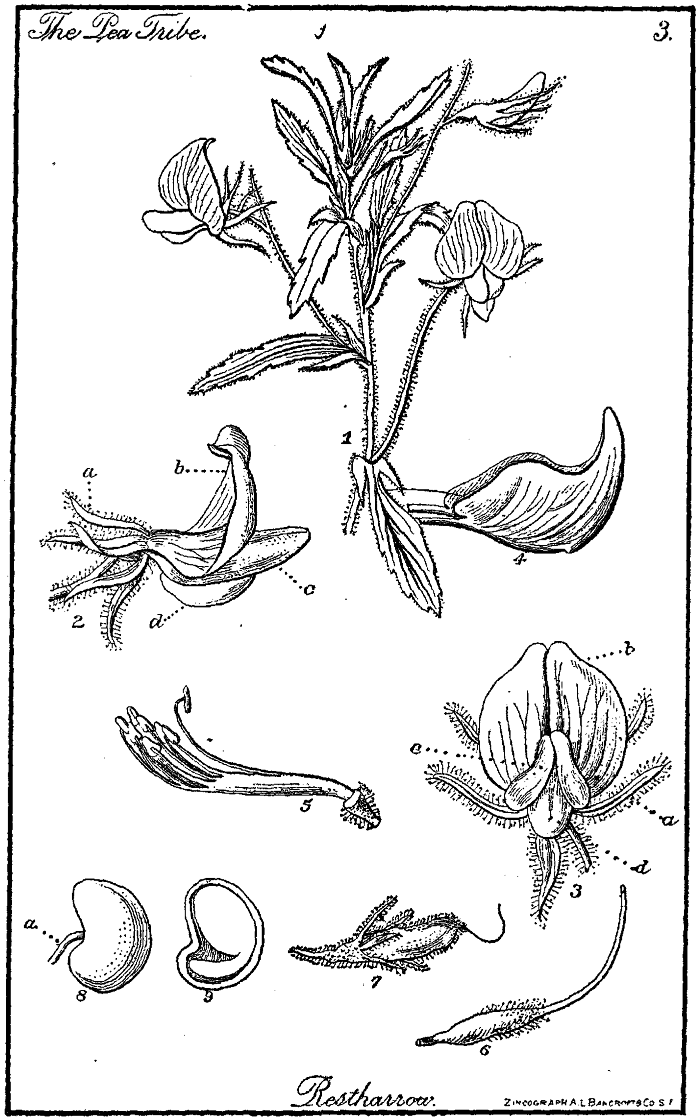
EXPLANATION OF PLATE I.

THE CROWFOOT TRIBE.—*A*. A twig of the upper part of the stem of a Buttercup or Crowfoot; *a a*, bracts; *b*, calyx. 1. A petal seen in the inside, with the scale at the base. 2*. An anther seen with a part of the filament, seen in front. 2**. The same more magnified, viewed sidewise. 3. The center of a flower cut through, the calyx and corolla being removed; the stamens are seen spreading outwards, with their filaments originating from underneath the carpels; the latter occupy the center, and are shown to arise from a short, conical central part, which is their receptacle. 4. One of the carpels; *a*, the ovarium; *b*, the style; *c*, the stigma. 5. The same carpel cut open, so as to show the young seed, or ovule, *d*. 6. A cluster of ripe carpels, or grains. 7. One of the grains separate; compare this with fig. 4, on the opposite side of the plate. 8. The same grain cut in half, showing *a*, the young plant or embryo, and *b*, albumen or nutritive matter, stored up for feeding the young plant when it begins to grow. 9. Is an embryo extracted from the albumen, and seen from the back. 10. The same seen from the side, so as to show the two minute seed-leaves or cotyledons, *a*. (N. B.—The principal part of these figures is more or less magnified.)



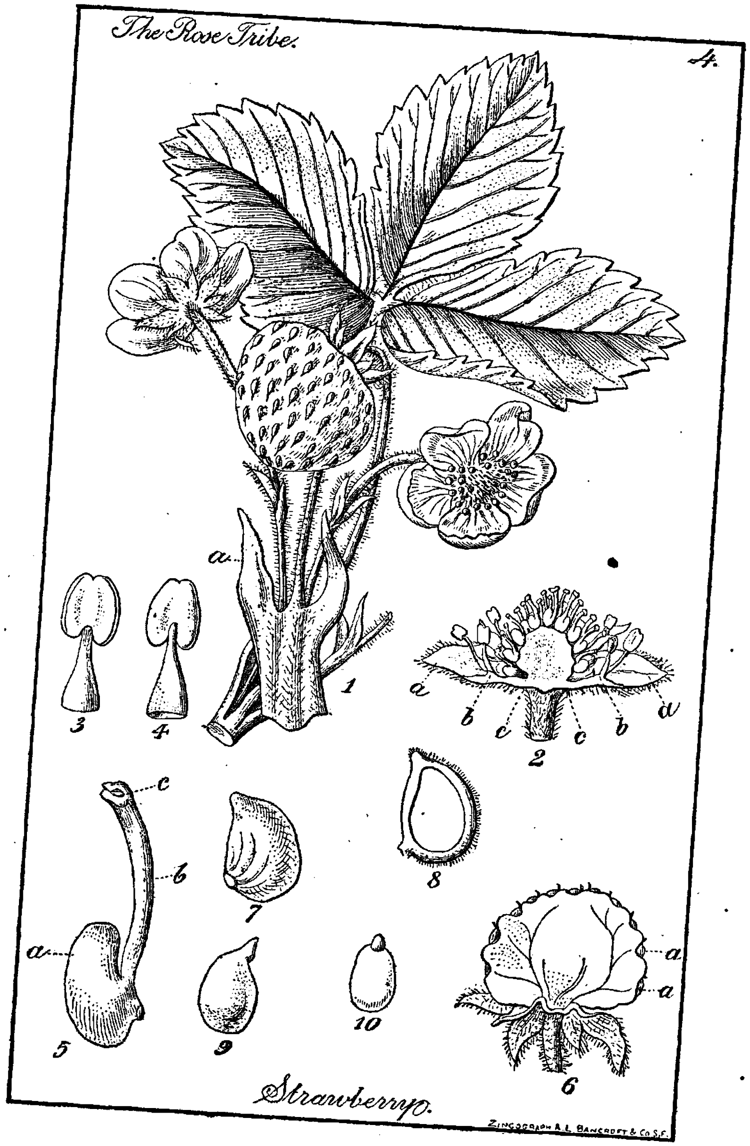
EXPLANATION OF PLATE II.

The Cruciferous Tribe.—A sprig of *Shepherd's Purse.* 1. A flower with all its parts in their natural position. 2. The same flower without the calyx and corolla; it shows the two side stamens, which are the shortest. 3. An ovary cut across, exposing the partition, the two cavities and the young seeds, or ovules. 4. An ovule apart, with the end by which it hangs from the side of the partition. 5. The stigma, with the style and a portion of the shoulders of the ovary. 6. A ripe silicle; *a a*, the valves; *b*, the point of the partition. 7. The partition from which the valves have been removed, showing the numerous seeds which hang to it. 8. The partition seen in front, with the marks of the places to which the seeds were attached. 9. A ripe seed, covered with fine hairs. 10. The same cut through perpendicularly, showing how the embryo is doubled up within it. 11. The same seed, cut through horizontally; *a*, the radicle; *b*, the two cotyledons. 12. An embryo pulled out of the seed-coat and straightened.



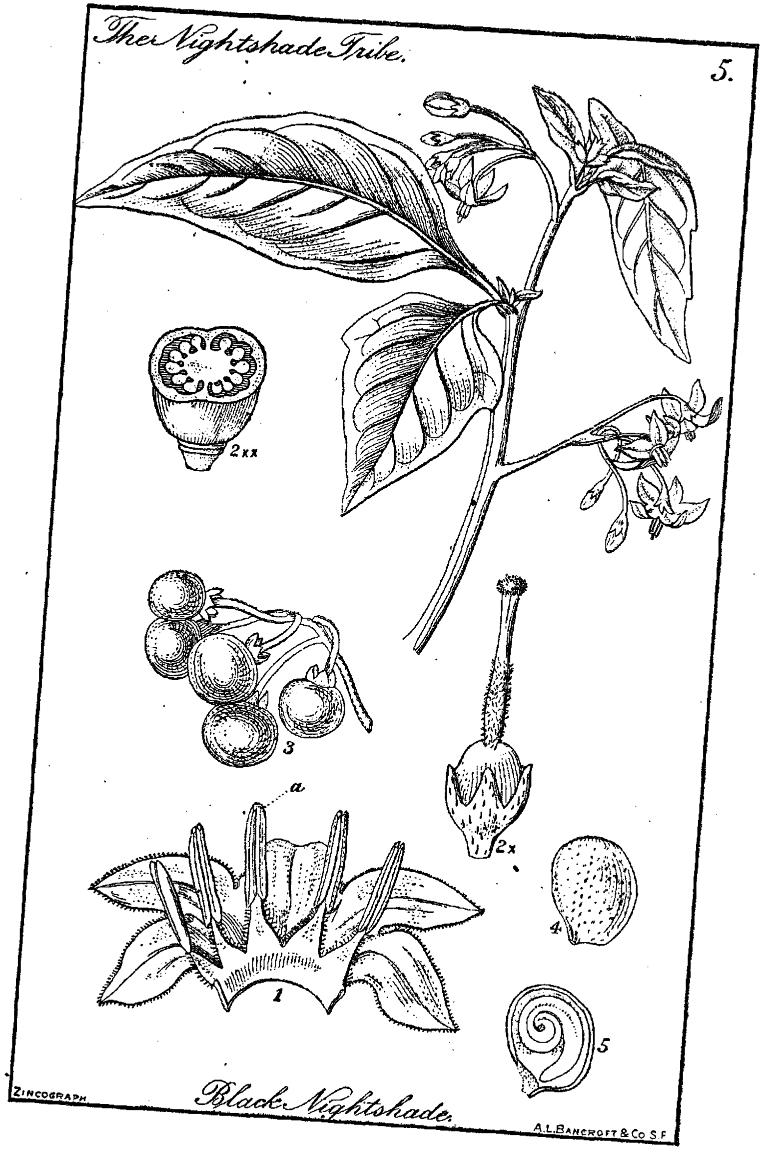
EXPLANATION OF PLATE III.

The Pea Tribe.—1. A piece of the *Narrow-leaved Restharrow* (*Ononis angintifolia.*) 2. A flower seen from the side; *a*, sepale; *b*, standard; *c*, wings; *d*, pod. 3. The same flower seen in front; the letters refer to the same parts. 4. A pod apart, showing the two stalks of the petals which form it. 5. Stamens. 6. A pistil. 7. A ripe legume, with the calyx adhering to it. 8. A seed; *a*, the cord by which it was attached to the receptacle. 9. The same cut open, showing the position of the embryo, of which one cotyledon only is visible.



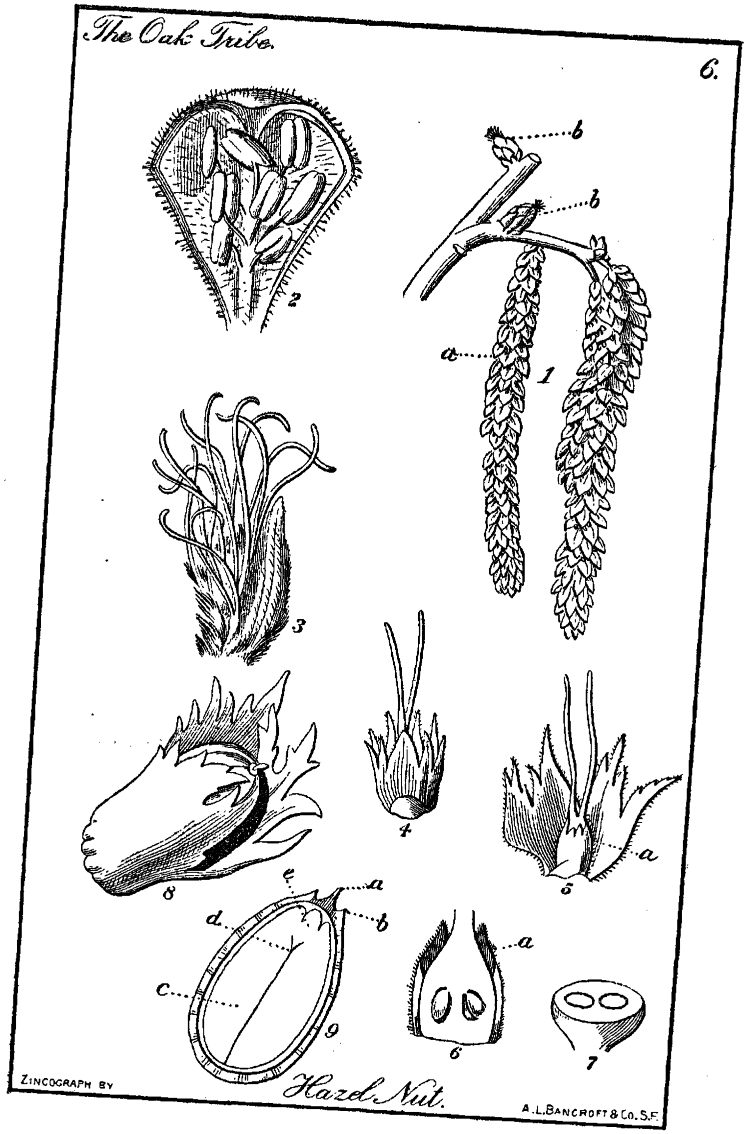
EXPLANATION OF PLATE IV.

THE ROSE TRIBE.—1. A leaf, a few flowers, and fruit of a *Strawberry Plant; a*, stipules. 2. The calyx and pistil cut through to show the origin of the stamens; *a*, sepals; *b—c*, tube of the calyx. 3. A stamen seen in front. 4. The same seen from the back. 5. A carpel; *a*, the ovary; *b*, the style; *c*, the stigma. 6. A fruit cut through perpendicularly to show the fleshy receptacle, and the grains, *a*, sticking to it. Compare this with fig. 2. 7. A ripe grain. 8. The same cut through to show the seed. 9. A seed extracted from the grain. 10. An embryo with the radicle at the upper end.



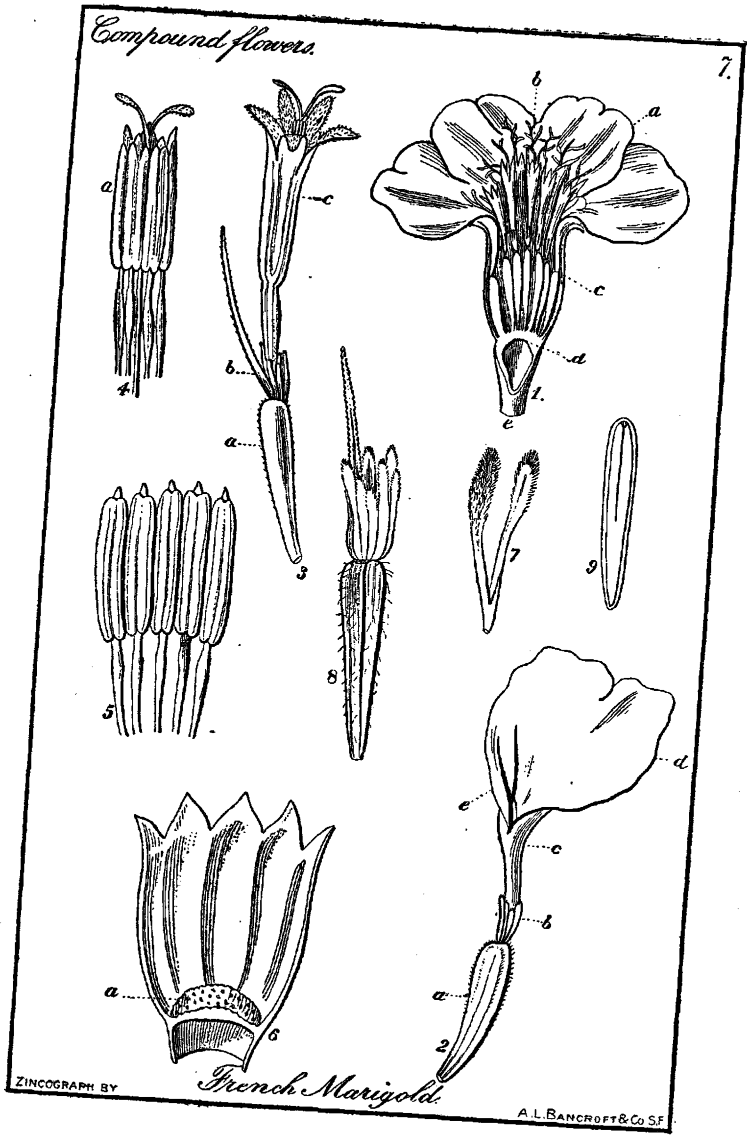
EXPLANATION OF PLATE V.

THE NIGHTSHADE TRIBE.—A twig of Black Nightshade. 1. A corolla laid open; *a*, the holes through which the pollen is discharged by the anthers. 2*. The pistil and calyx. 2**. A horizontal section of the ovary, exhibiting the numerous seeds lying in the two cells. 3. A cluster of ripe fruit. 4. A seed. 5. The same divided perpendicularly, showing the manner in which the embryo is coiled up.



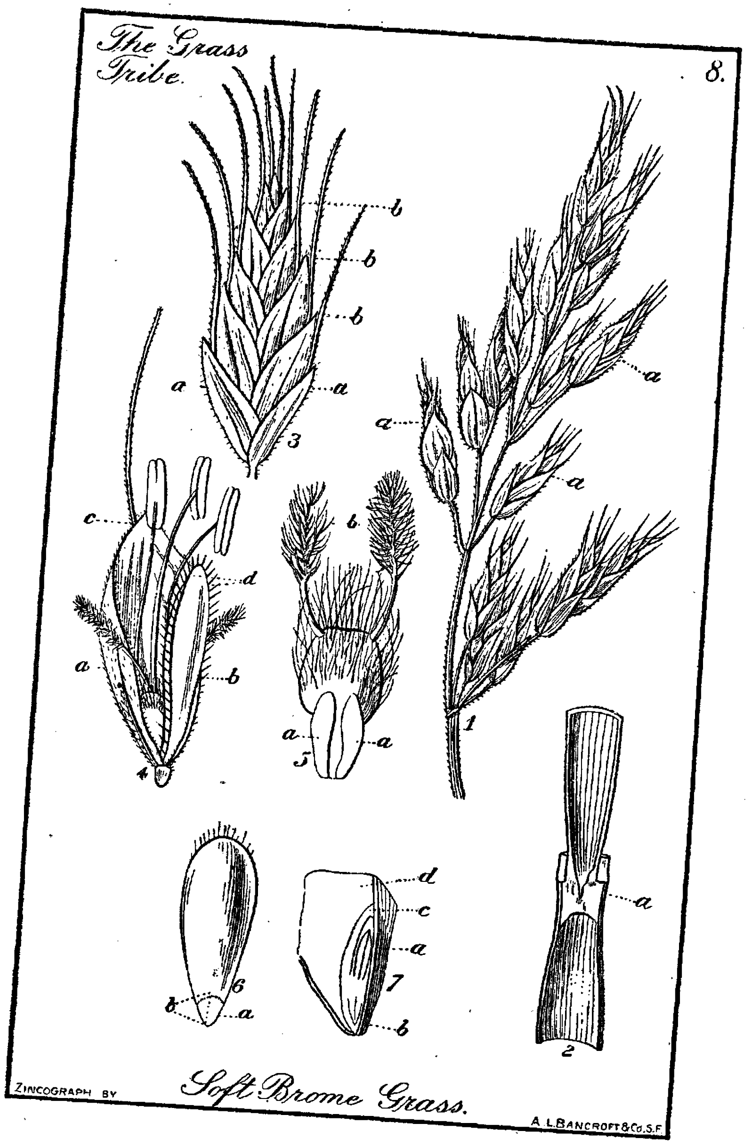
EXPLANATION OF PLATE VI.

THE OAK TRIBE.—1. A twig of *Hazel* (*Corylus Avellana*); *a*, the stamen-bearing catkins; *b*, the buds containing the pistils. 2. A scale of the catkin, showing the two lobed body, and the stamens. 3. A cluster of pistils bearing flowers, in a very young state, with only one of the scales by which they are protected, remaining. 4. A pistil-bearing flower, inclosed in its involucre. 5. The same cut open; *a*, the calyx. 6. An ovary divided perpendicularly; *a*, the calyx. 7. The same divided horizontally. 8. A ripe nut in its husk, or involucre. 9. A nut cut through perpendicularly; *a*, the remains of style; *b*, remains of calyx; *c*, cotyledons; *d*, plumula; *e*, radicle.



EXPLANATION OF PLATE VII.

COMPOSITE FLOWERS.—1. Half a flower-head of *French Marigold* (*Tagetes patula*); *a*, florets of the ray; *b*, florets of the disk; *c*, section of involucre; *d*, receptacle; *e*, flower stalk. 2. A floret of the ray; *a*, ovary; *b*, pappus; *c*, tube, and *d*, blade of the corolla. 3. Floret of the disk; *a*, ovary; *b*, pappus; *c*, corolla. 4. Cylinder of stamens. 5. The same slit open and unrolled. 6. Half an involucre; *a*, the receptacle. 7. The two stigmas. 8. A grain, ripe and crowded by the pappus *b*. 9. A section of a seed, showing the embryo.



EXPLANATION OF PLATE VIII.

THE GRASS TRIBE.—1. A piece of the inflorescence of *Soft Brome-grass* (*Bromus mollis*); *a a*, spikelets. 2. A perpendicular section of a portion of the stem, showing the partition at *a*. 3. A spikelet; *a a*, glumes; *b b b*, florets. 4. A floret half open; *a*, the lower palea; *b*, the upper palea; *c*, the beard; *d*, the angles of the upper palea covered with stiff hairs. 5. A pistil; *a a*, hypogynous scales; *b*, stigmas. 6. A ripe grain; *a*, the place where the embryo lies; *b*, the piece which is cut out, and seen magnified at 7, where *a* is the plumule; *b*, the radicle; *c*, the cotyledon, and *d*, the albumen.

a young seed called an Ovule (fig. 5, *d*), or little egg; so that the carpel, instead of being the seed, is the part that contains the seed.

Although the ovule is really the young seed, yet it is not always certain that it will grow into a seed; whether or not this happens depends upon the pollen, of which we have already spoken, falling upon the stigma. If the pollen does fall on the stigma, it sucks up the moisture it finds there, swells, and finally each of the minute grains, of which it consists, discharges a jet of matter upon the stigma, which fertilizes the ovule, and then the latter grows and becomes a seed. But if the pollen does not fall upon the stigma, then the ovule withers away, and no seed is produced. Thus you see every one of the parts of the flower is formed for some wise purpose.

You have now seen all the parts of which flowers usually consist; the *fruit is merely an alteration of* the carpels, and the seed of the ovules. The fruit of the Buttercup is almost exactly the same when ripe as when young, except that its parts are larger, and it has become brown, dry, and hard (fig. 6.) Separate, at this period, one of the carpels from the remainder, and place it under a magnifying glass. The inside of the carpel is filled up with the seed now arrived at its perfect state; the shell of the carpel has become hard and thick, and not only effectually protects the seed from harm (fig. 8, *a*), but keeps it in the dark, another wise provision, for without darkness the seed could not grow. The shell thus altered is called the Pericarp.

If you cut the seed through, you will, for a long time, discover nothing but a solid mass of white flesh, in which all the portions seem to be alike; but if you happen to have divided it accurately, from top to bottom, cutting through both edges of the grain as at fig. 8, you will then be able to discover near the base of the seed a very minute oval body (fig. 8, *a*), which may be taken out of the flesh with the point of a needle. This oval body is a young plant—it is the part which grows when the seed germinates, and is named the Embryo; the fleshy matter that surrounds it, called Albumen, is only intended to nourish the young and delicate embryo when it first swells and breaks through the shell. Small as is the embryo, so small as to be invisible to the naked eye, it also is constructed in a regular manner. It is not merely an oval, fleshy body, but it has two differently organized extremities, of which the one is divided into two lobes, called Cotyledons (fig. 10), or seed-leaves, and the other is undivided, and called Radicle. The latter is the beginning of the root, as the former are the beginnings of leaves. Let the seed fall upon the earth; the embryo imbibes moisture, swells, and shoots forth into a young plant.

Such is the structure of a perfect flower, and such the principal terms which you have to remember in order to understand the language of botanists.

By far the greater part of the characters which we have seen that the Buttercup possesses, will be also found in other and extremely different plants; but there are two characters which are what we call essential—that is to say, such as will distinguish it and the other plants belonging to the same natural order from other natural orders resembling it. These essential characters are, *there being a great many stamens which arise from beneath the carpels*—which is what botanists term being hypogynous (Pl. I, fig. 3)—*and also several carpels which are not joined together.* If you will pay attention to these two circumstances, you will

always know a ranunculaceous plant—that is to say, a plant belonging to the Buttercup family.

The floral parts and their relative positions having been thoroughly mastered, the student may now proceed and compare with the Buttercup any species of Larkspur (*Delphinium*), Columbine (*Aquilegia*), Pæony (*Pæonia*), and Virgin-Bower (*Clematis.*) In all cases the same relative position of the floral parts will be observed, though the peculiarly shaped petals of the Columbine and the odd-shaped sepals of the Larkspur may puzzle the student at first.

II.—THE CRUCIFEROUS FAMILY.

The healthy stimulating effects of Mustard and Cress, and the nutritive properties of Turnips and Cabbages, are well known to everybody. These plants belong to an extensive tribe called Cruciferous or Cross-bearers, because their four petals are placed in such a way as to resemble, in some degree, a Maltese cross.

Many of my readers are already, I suspect, familiar with a mean-looking weed called Shepherd's Purse (*Capsella bursa pastoris*), which is found everywhere, at all seasons of the year.

The flowers are arranged regularly upon a central stalk in the form of a *racenee;* and, what is extremely singular, they are uniformly destitute of bracts. This is so unusual a case that I do not remember any other instance in the whole vegetable kingdom in which bracts are so constantly absent; the absence of these little leaves (bracts) is hence a mark of the Cruciferous family.

But it is not thus alone that Cruciferous plants may be recognized. The structure of their flower is of a very peculiar kind. The calyx is formed of four little leaves or sepals, within which are four very small white petals, arranged in the manner already stated; hence, the appellation of Cross-bearers (fig. 1). Within the petals are six stamens (fig. 2), of which two are a very little shorter and more spreading than the other four. To this character no parallel is to be found in any other than Cruciferous plants, and consequently it is a second essential character by which they are to be known.

The pistil is an oval green body, shaped something like a wedge, on the summit of which is a little cushion or stigma, seated on an exceedingly short style (fig. 2). If you cut open the ovary you will find (fig. 3) that it contains two cells, in each of which are a number of young seeds or ovules, hanging by slender thread-like stalks.

The fruit (fig. 6) becomes a wedge-shaped flat body, composed of three pieces, two of which (fig. 6, *a a*) the valves, separate from the third (fig. 6, *b*), which is named the *partition* or *dissepiment* (fig. 8); it is to the edges of this third piece that the seeds stick by little threads (fig. 7). In the inside of these seeds the embryo is bent double, after a singular fashion (fig. 10), the seed-root being pressed close to the back of the seed-leaves.

This has been rather a wearisome lesson; but you have now the satisfaction of knowing that you possess the secret of recognizing with certainty nearly a thousand species, scattered over the face of the world, all of which are harmless, and many highly useful.

What would the farmer do without turnips and rape; or the gardener without cabbages, sea-kale, mustard, cress, and radishes; or the florist without wall-flowers, stocks, and candytuft—all Cruciferous plants? All these are such common plants that you have no difficulty in procuring specimens for examination; you will find that while they are all unlike in trifling circumstances, they agree in having their parts arranged exactly in the same manner as in the Shepherd's Purse; but you will remark a difference in their fruit, of this nature: in some of them, as in the Shepherd's Purse itself, the pod is so very short that there is not much difference between its length and breadth; in others it is very long and slender, as in the turnip and cabbage.

Any one of the following plants, so very common in our gardens or fields, may be selected instead of the Shepherd's Purse: Candytuft (*Iberis*), Sweet Alyssum, Wallflower (*Cheiranthus Cheiri*), Marsh-Cress (*Nasturtium palustre*), Winter Cress (*Barbara vulgaris*), Western Wallflower (*Erysimum asperum*) Peppergrass (*Lepidium*).

In conclusion, I request again the reader not to study these articles on Botany without specimens in hand, for without them it is wasting time.

III.—PEA FAMILY (*Leguminosæ.*)

There is, perhaps, no natural order of plants which is more easily recognized than the Pea family, or one in which greater interest is usually taken; it is so rich in plants useful for food, as the Pea, Bean, etc., or for forage, as Clover and Alfalfa; or dyes, as Indigo and Logwood; or timber, as Rosewood and the American Locust trees; or medicine, as the Senna plant; or gums, as the Arabian Acacia; and attractive for their beauty, as *Robinias*, Lupines, *Swainsonias*, *Clianthus*, Sweet Peas, and a large number of others, too numerous to enumerate. Most all of the plants above mentioned are largely cultivated in our gardens and fields. It is, therefore, quite easy to procure specimens for examination.

The Pea family consists of plants bearing pods, formed upon the same plan as that of the Pea, and called *legumes;* this is the great essential character, and the only one which is universal. It is therefore necessary to teach you, in the first instance, how you are to know a Legume with certainty. Imagine to yourself a carpel, which grows long and flat, and usually contains several seeds, and which, when ripe, separates into two valves or halves; recollect, also, that the seeds all grow to one angle only of the inside of the carpel; in a word, study a pea-pod, and you will know what a legume is. You must not expect, however, that it will always be exactly like a pea-pod; on the contrary, it is longer or shorter, larger or smaller, harder, thinner, or differently colored, contains more or fewer seeds; or, in short, may vary in many ways; but it will always be formed upon the same plan. This is what you are to take as the character which holds together all the subdivisions of the Pea family.

The most striking feature in these plants, next to the legume, is the singular arrangement of the petals, which gives to a very large proportion of this whole natural order the name of *Papilionaceous*, or Butterfly-flowered. By this title we distinguish the first division of the Pea family; as an example of which the common Pea or Lupine flower would answer the purpose. (The plant, however, illustrated here is the Restharrow, *Ononis angustifolia.*) The calyx is formed of five sepals that unite in a short tube (figs. 2 and 3, *a*). The corolla consists of five petals, one of which is larger, and stands at the back of all the others, wrapping them up before the flower expands (figs. 2 and 3, *b*); this is the *Standard*, or *Vexillum*. In front of the Standard are two

smaller petals (figs. 2 and 3, *c*), which are placed nearly parallel with each other, converging a little at the point; they are *Wings*, or *Alæ*, and are carefully folded over a boat-shaped curved part of the corolla, which is placed in front of all the rest; this part, called the *Keel*, or *Carina* (figs. 2 and 3, *d*), is formed of two petals, which are slightly united at their lower edge, as you may discern by pulling the keel away from the calyx, when you will see their two stalks (fig. 4); the corolla is, therefore, formed of the same number of parts as the calyx, but so masked that you would not have at first suspected such a thing. This is called a butterfly-shaped flower.

Let us miss the stamens for the present, and pass on to the ovary (fig. 6), which is a tapering, green, hairy part, gradually narrowing into a style, which ends in a minute stigma. Its legume is a short, flat body (fig. 7), to which the withered style adheres or sticks. When ripe it splits into two halves, to each of which a seed or two (fig. 8) is attached.

Papilionaceous flowers may be themselves separated into those which have their stamens united, and those which have their stamens separate. To the first belongs the Restharrow, which has nine of the stamens joined together about half-way (fig. 5), and a tenth a little separated from the others. It is here, also, that are found nearly all those species of the Pea family with which you are likely acquainted. Peas, Beans, Clover, and Alfalfa are known to everybody; and these may be easily procured for examination.

The Pea or Pulse family (*Leguminosæ*) is one of the largest of the vegetable kingdom. Its members are found all over the globe. They increase in number, beauty, and variety towards the equator.

This large family of plants divides itself into three large sub-families. Of every one we find representatives here in California, either indigenous or exotic.

SUB-FAMILY I. *Papilionaceæ* (proper Pea family). General characteristics: sepals imbricated in æstivation; corolla papilinaceous; stamens ten or occasionally fewer, inserted with the petals into the bottom of the calyx.

Belonging to this sub-family we find here: Lupines (*Lupinus*), Clover (*Trifolium*), Alfalfa (*Medicago Sativa*), Locust tree (*Robinia*), Bur-clover (*Medicago*), Rattle-weed or Milk-vetch (*Astragalus*), Peas (*Lathyrus*), Australian Pea-vine (*Dolichos*), *Clianthus* and *Swainsonias*.

SUB-FAMILY II. *Caesalpinieæ* (Brasiletto family). General characteristics; flowers not papilinaceous; petals spreading equally around the pistil, as in other plants; stamens usually separate and spreading. The irregularity of growth which causes the papilionaceous appearance in the first sub-family also exists among these plants, so that you will find them with some of their petals and stamens larger than the remainder.

Belonging to this sub-family we find here: Judas tree (usually a shrub) (*Cercis occidentalis*), Honey-locust (*Gleditschia*), and various species of Cassia, introduced and cultivated in our gardens. These have pinnate leaves and yellow flowers, and generally bloom when our rainy season begins.

SUB-FAMILY III. *Mimoseæ* (Mimosa family). General characteristics: sepals and petals so small as to be scarcely visible; flowers in compact clusters; and the stamens not only very numerous, but so long and slender and delicate as to resemble silken threads, tipped with very little anthers.

To this sub-family belong all the beautiful acacias introduced from Australia into our gardens. They bloom chiefly during our rainy season. The Australian settlers call them Wattle-trees.

IV.—THE ROSE FAMILY.

In this article we shall consider the structure of the Rose family, the most important of the whole vegetable kingdom, save that of the grapes.

The Strawberry (*Fragaria*) is an herb with three-parted leaves, and a pair of large membranous stipules at their base. (See plate 1, *a*.) The veins of the leaves are netted. When the Strawberry plant is about to multiply itself it puts forth naked shoots of two sorts. One kind is prostrate on the ground, and ends in a tuft of leaves, which roots in the soil, thus forming a new plant, or, as it is technically called, a runner; the other kind of shoot grows nearly erect, and bears, at its end, a tuft of flowers, which afterwards becomes fruit, or at least what is commonly called so.

The calyx of the Strawberry is a flat, green, hairy part, having ten divisions; it is, therefore, caused by the union of ten sepals, five of which are on the outside of, and smaller than the others.

The corolla consists of five petals.

The stamens are very numerous, and are placed in a crowded ring round the pistil, as in the Crowfoot, or Buttercup; but you will observe that they grow out of the side of the calyx (fig. 2), and not from beneath the carpels.

The pistil of a Strawberry is very much like that of a Buttercup. It consists of a number of carpels, arranged in many rows, and with great order, upon a central receptacle. Each carpel has a style, which arises from below its point (fig. 5), and terminates in a slightly lobed stigma. In the inside of the ovary is one single ovule. With the flower the resemblance between the Buttercup and Strawberry ceases.

You will almost wonder, now that you know how the young flower of a Strawberry is constructed, how so singular a fruit is to be formed out of such materials, especially if you should have chanced to meet with the ingenious explanation given of it by some botanist, whose name I forget, that it is a berry with its seeds on its outside. Many and strange are often the changes that take place in the organization of a pistil in the course of its transformation into a fruit, and they are highly curious in this case. If you would really understand them, you should watch the Strawberry in the progress of its growth. You would then see that the first occurrence after the petals have fallen off, and the calyx closed on the tender fruit, consists in the receptacle of the carpels beginning to swell, and, shortly after, in the carpels themselves gaining a greater size and a more shining appearance, while, at the same time, their styles begin to shrivel up. At a more advanced stage the carpels are found but little augmented in size, while the receptacle has increased so very much in dimensions that the carpels are beginning to be separated by it, and the surface of the receptacles can be distinctly seen between them. A little older, and the carpels seem scattered in an irregular manner over the surface of the receptacle, which has become soft and juicy, while the carpels have remained almost stationary in size. All along, the swelling receptacle has been pushing the calyx aside, as being no longer of use to it; and at last you scarcely remark the calyx, in consequence of the much greater size of the receptacle. This

part finally gains a crimson color, swells more and more rapidly, acquires sweetness and softness, and at last is the delicious fruit you are so well acquainted with. In that, its final state, the carpels are scattered over its surface in the form of minute grains, looking like seeds, for which they are usually mistaken. You, however, know better than to fall into this common error, for you have seen that at first they had each a style and stigma, which seeds never have; and you can now, by cutting them open (fig. 8), detect the seed (fig. 9) lying in the inside of the shell of the carpel. The Strawberry is, therefore, not exactly a fruit, but is merely a fleshy receptacle bearing fruit, the true fruit being the ripe carpels.

The Raspberry, Blackberry, and Thimbleberry, also claim kindred with the Strawberry, because of their likeness to it. They are shrubby plants. In this respect they differ from the Strawberry. Their calyx has only five divisions instead of ten, which is a difference; but their petals are five; the stamens numerous, and arising out of the side of the calyx, and their pistils composed of a number of carpels arising out of a central receptacle; these, again, are resemblances with the Strawberry in important points. Let us examine the fruit. The Raspberry has a dry core, off which you may pull the little thimble-like fruit, and you will not find any of the dry grains which stick upon the outside of the Strawberry. But look again. What are the little dry threads that you see rising from the center of a multitude of little projections, with which the whole surface of the Raspberry is covered? Surely they are styles; and, if so, the projections out of which they grow must be carpels in a ripe state. This is really the case. The carpels of the Raspberry, instead of remaining dry as they become ripe, swell and acquire a soft pulpy coat, which, in time, becomes red. They are crowded so closely, that by degrees they press upon each other, and at last all grow together into the thimble-shaped part which you eat. In order to gain this succulent state they are forced to rob the receptacle of all its juice, and, in the end, separate from it, so that when you gather the Raspberry you throw away the receptacle under the name of core, never suspecting that it is the very part you had just before been feasting upon in the Strawberry. In the one case the receptacle robs the carpels of all their juice in order to become gorged at their expense; in the other case the carpels act in the same selfish manner towards the receptacle.

It is now necessary that we should examine the Rose, this charming flower, in the construction of which you will find as much to admire as in its external attractions. In the flower much seems to differ, although in reality but little essential difference exists between the Roses and other Rosaceous plants. It has a calyx of five divisions, some of which are very like small leaves. To these succeed five petals, and within the latter is a great number of stamens, which grow from the side of the calyx. You will not, at first sight, perceive any pistils. In the center, indeed, is a tuft of stigmas, but no ovaries are visible; upon further search, however, you may discover, especially if you press the flower forcibly between the finger and thumb, that the styles project through the neck of an oblong green body, which being below and on the outside of the calyx, looks like an inferior ovary. If you split the flower perpendicularly you will then perceive that this body that looks like an inferior ovary is, in reality, the tube of the calyx, which is contracted at the place where the stamens originate, into a narrow orifice, through which the tops of the styles protrude, or forming as usual the bottom of the styles. The ripe fruit, or hep of the Rose, is nothing more than

the same tube of the calyx turned red and fleshy, the sepals, and petals, and stamens having dropped off. In its inside will be found the carpels changed to bony grains, covered with coarse stiff hairs.

Thus far we have treated of plants belonging to the first tribe of the Rosaceous family; but in order to demonstrate the great importance of this family to mankind, we must consider also two other groups or tribes of plants, usually classed with the Rosaceous family, namely: the Apple and the Almond tribe.

In the Apple tribe, to which belong all those plants which agree with the Rose tribe in everything but the carpels being distinct and superior, we find that the carpels are united, and that they adhere to the tube of the calyx. Take an apple tree in flower as an example of this. The calyx has five divisions, the petals are five, and there are a great many stamens growing out of the sides of the calyx In the center you will find five styles, but their ovaries, instead of being merely inclosed within the tube of the calyx, adhere and form one body with it. It is this circumstance that gives rise to all the difference that you find in the fruit itself. An apple is a large fleshy body, having at one end what is called an eye, which is in reality the remains of the calyx surrounding the withered stamens. The principal part of the flesh is the tube of the calyx, but the central part is the carpels, also grown fleshy, and at this period undistinguishable from the calyx itself; that their number was five is shown by the five cavities in the center of the fruit, each of which contains one or two seeds. Now it is obvious, if this description be carefully considered, that the fruit is the only thing by which the Apple is known for a Rosaceous plant. The same kind of structure is found in the Pear, Quince, Mountain Ash, Medlar, and Hawthorn.

The Almond group or tribe.—This is less different in structure than the Apple tribe, but more dissimilar in sensible properties. It consists of species which have all the essential parts of structure of a common Rosaceous plant, but which bear fruit like that of a plum. The Plum tree flower has a calyx of five parts; five petals, and a great number of stamens arising out of the sides of the calyx. But, in place of many carpels, there is only one; and that one changes to a fleshy body containing one single seed inclosed in a hard stone. The hard stone is the lining of the cell of the carpel, separated from the fleshy rind that is on the outside. This kind of fruit is called a Drupe. What is found in the Plum exists equally, and but little modified, in the Apricot, Peach, Nectarine, Almond, Sloe, and Cherry, all of which are species of the Almond tribe.

Instead of being perfectly wholesome, some members of this tribe are highly poisonous, as the common Laurel (*Prunus laurocerasus*), the leaves of which yield the dangerous infusion called laurel-water. This is owing to their yielding a volatile principle called prussic acid, which, in its concentrated state, is one of the most dangerous poisons. Plants of the Almond tribe have also this peculiarity in which they differ from Roses: their bark yields gum, as you may see by the cracked branches of diseased cherry and peach trees.

If you analyze the characters of these tribes, you will find that their differences arise mainly from the relative position of the ovary, whether it is superior or inferior; and their differences may be expressed thus:

Rosaceous family.	Ovary superior,	many carpels—Rose tribe.
		one carpel—Almond tribe.
	Ovary inferior	........................Apple tribe.

A family of such vast importance to us, both in an economic as well as an ornamental point of view, should be carefully studied and well mastered. This can be easily done, for there is certainly no want of proper material for illustration. What place in California could be found not having some kind of those plants above mentioned under cultivation?

But it is desirable to acquaint our children also with some indigenous plants belonging to this family. To the Almond tribe belong: *Cerasus ilicifolius*, an evergreen cherry, forming often a beautiful tree in favorable localities. *Prunus subcordata*, the beautiful wild plum of the higher Sierras — Downieville, Sierra Valley, Mount Shasta, etc.—so largely collected by our people inhabiting those sections of the State.

To the Rose tribe belong: *Nuttallia cerasiformis*, a beautiful deciduous shrub. *Spiræa opulifolia*, Nine-Bark, a large bush very common on all our streams. *Spiræa ariæfolia*, also a large bush and quite common on the banks of creeks. *Spiræa Douglasii*, a beautiful bush growing in the mountains, and also cultivated in our gardens. Spiræas are usually called Meadow Sweet. *Adenostoma fasciculata*, the well-known chemisal forming the dark-looking chaparral which covers so many of the hillsides in the interior of the State. *Fragaria Chilensis*, a wild strawberry, generally found on sandy soil near the coast line. *Rubus Nutkanus*, the Thimbleberry. *Rubus spectabilis*, the Salmonberry, found growing along our northern coast.

To the Apple tribe belong: *Photinia arbutifolia*, the Tollon of the Mexicans, a tall shrub or small tree on hillsides and banks of creeks, quite ornamental in Fall on account of its scarlet-red berries, borne in large heavy bunches at the end of the upper branches. In Spring it is almost equally ornamental on account of its numerous bunches of small white flowers. It is an evergreen, and sparingly cultivated in gardens. If this beautiful plant had come to us from Japan or any other distant country, it would be found in every garden. *Amelanchier canadensis*, the Serviceberry, or Juneberry, a large white-flowering shrub found almost in all parts of the State, especially northward.

V.—THE SOLANACEOUS FAMILY.

All dicotyledonous (two seed-leaved) plants are divided into polypetalous, monopetalous, and apetalous. To the polypetalous division belong all plants having a corolla consisting of several separate petals. Four families of this division were treated of in our previous articles. With the present, we begin to illustrate a family belonging to the second division, the monopetalous. To the monopetalous division belong all plants having a corolla whose petals are all coherent, forming a tube of greater or less extent. Of the third, the apetalous division, we shall treat hereafter.

From the harmless natural orders, so far considered in our illustrated articles, we now turn our attention to one, the properties of which are often dangerous. Henbane, Nightshade, Tobacco, Thorn Apple, and the half fabulous Mandrake, form, with a number of other plants (Tomato, Potato), a large natural order, the prevailing quality of which is to be poisonous. Many of them are common wild plants, and none more so than the species called Black Nightshade (*Solanum nigrum*), which is sure to spring up wherever a spot is neglected and suffered to become waste. We select this common plant to explain the general character of the Nightshade family. If the nightshade, however, cannot be had, any other plant named in this article may be substituted therefor.

Black Nightshade is a plant with broadly lance-shaped leaves, slightly toothed at the edge, and seated alternately upon the stem. Its flowers consist of a short five-toothed calyx, of a monopetalous corolla, with five equal divisions (fig. 1), of five equal stamens, and of an ovary (fig. 2 * *) with two cells, in each of which are a number of ovules. The style of the ovary is thick and shaggy at the bottom, and terminated by a thickened undivided stigma. The fruit is a small thick berry, containing two cells, and a number of yellowish seeds whose skin is covered closely with little pits (fig. 4); in the inside is an embryo, which is coiled up upon itself in the middle of a quantity of fleshy albumen (fig. 5). Of these characters, the most essential ones are the superior ovary with two cells, the regular flower, and the alternate leaves.

The genus Solanum is known in its family by the anthers opening by two holes or pores at their points (fig. 1, *a*); besides Black Nightshade, it contains the Bitter-Sweet (*S. Dulcamara*), whose red and tempting berries present a dangerous temptation to children; the Love Apple or Tomato (*S. Lycopersicum*); the Egg-plant or Aubergine (*S. Melongena*), whose fruit, when fried in slices, forms a delicacy in French cookery; and above all, the Potato (*S. Tuberosum*). Here is a singular assortment of eatable and poisonous plants in the same genus; but in truth, the fruit of these is in all cases deleterious till it is cooked. Egg-plants are washed and fried before they are eaten. The fruit of the Potato is notoriously unwholesome; and if its roots are not so, that circumstance is to be ascribed in part to their being composed almost entirely of a starchy substance, which in no plant is poisonous, if it can be separated either by heat or by washing from the watery or pulpy matter it may lie among.

California has but very few indigenous plants belonging to the Solanaceous family. Those found in waste-places and in our gardens were introduced from other countries, either intentionally or by chance. To the latter belong Thorn Apple (*Datura Stramonium*), so celebrated for its narcotic properties; it is distinguished by its fruit being dry and covered with stiff spines. This obnoxious plant is fast spreading all over this State.

Solanum unbelliferum is the only conspicuous and indigenous plant of this family likely to attract the beginner on his excursions. It is found on the Coast Ranges, as well as on both slopes, eastern and western, of the Sierras. It is a low semi-herbaceous shrub, with dark green leaves and dark blue flowers, borne in racemes at the end of the branches. We possess also a species of wild tobacco, with long tubular flowers of a greenish-white color.

VI.—THE OAK TRIBE.

The Hazel, when young, is one of the most accessible plants to you, and affords a good illustration of the structure of the apetalous division of dicotyledonous plants. At the earliest period of Spring you must have remarked the branches of the Hazel loaded with little yellow tails, which swing about as the wind disturbs them, and fill the air with a fine powder, the particles of which may be seen glittering in the sunbeams like motes of gold. These tails are called *Catkins* (fig. 1, *a*), and

are composed of a great number of little scales, which are arranged, one behind the other, with the utmost regularity, as you may easily discover by inspecting them before they separate. Each scale has on its inner face about eight anthers, that seem to rise out of a two-lobed flat body, which adheres to the scale (fig. 2); no other structure is to be found; apparently neither calyx, nor corolla, nor pistil; nothing but the two-lobed body sticking to the scale and bearing stamens. Botanists consider the scales bracts, and the two-lobed body a calyx in an imperfect state.

This then is an instance of a simpler kind of organization than any you have before met with in a flower. It is, however, not quite characteristic of the Oak tribe, for the Hornbeam has no calyx whatever, while the Oak, and the Beech, and the Sweet Chestnut, have a much more perfect one than the Hazel.

If the Hazel had none but stamen bearing flowers, you would never have any nuts in the Autumn, for there is nothing in those flowers which could, by any possibility, change into a nut. In this plant not only are the stamens and pistils in different flowers, but in different parts of the plant, and organized on quite a different plan. If you observe attentively those buds of the Hazel which grow near the *Catkins* (fig. 1, *b*, *b*), about the time when the stamens are shedding their pollen, you will perceive some little red threads protruding beyond the points of the buds, and spreading away from the center; those are the stigmas, and the pistils are inclosed within their scales, where they are safely protected from accident and cold. At the earliest moment when the stigmas can be discovered, let the scales be removed (fig. 3), and you will find the flowers clustered together among a quantity of soft hair, which seems provided as an additional means of shielding them from the weather, and to serve the same purpose as the warm lining of down which the birds provide for their young when they first break the shell, and before they are fledged. Each of these flowers is surrounded by a jagged sort of cup (figs. 4 and 5), which is originally much shorter than they are here, but which in time grows considerably longer; that cup is the involucre. The flower itself consists of a jagged superior calyx (fig. 5, *a*); an ovary with two cells and two seeds (fig. 6), and two long thread-shaped crimson stigmas. Thus you see the calyx of the pistil-bearing flower is much more perfect than that of the other kind of flower, but it is still very imperfect.

The pistils and the stamens being thus separated, there would be no chance of the pollen of the one falling on the stigma of the other and fertilizing it, unless an unusual quantity of stamens were provided; hence it is that on a fine day in Spring the whole air is, as I have just said, so impregnated with particles of pollen that they cover everything as with a fine dust.

By degrees, as warm weather advances, the protection of the scales of the bud ceases to be necessary to the young flowers, which swell and burst through them; the involucre daily grows larger; the stigmas having fulfilled their destiny, shrivel up; the ovary enlarges; one of its ovules grows much faster than the other, and gradually presses upon it till it smothers it; the shell hardens; an embryo makes its appearance, and by degrees fills up the cavity; and at last you have a perfect nut, with its husk (fig. 8) or involucre. At the point of the nut is to be seen the remains of the calyx (fig. 9, *b*); but no trace can be found of the cell and ovule which were smothered, so that a one-celled fruit is produced from a two-celled ovary. You will now know why nuts sometimes grow in clusters and sometimes singly. If cold or accident should destroy any part of the cluster of pistils in the bud, but a very few nuts, perhaps only one, will grow and ripen; but if they are mostly saved you will then have the large clusters which are so common in seasons which have been preceded by mild Springs. The nut itself affords an excellent illustration of the structure of a dicotyledonous embryo; the two great fleshy lobes into which the nut separates when freed from its skin (fig. 9, *c*), are the cotyledons; the little conical part at one end (*e*) is the radicle, and the small scale-like body which lies between them in the inside (*d*) is the plumule, or young stem.

Still more curious than those of the Hazel are the changes that occur during the growth of the fruit of other genera of the Oak tribe. In the oak itself the involucre is formed of a great many rows of scales, which gradually grow larger and harder, and more numerous, and at last become what you call the cup of the acorn, a part you never would have guessed could have been made out of a number of little leaves, if you had not watched their successive changes. The ovary at first contains three cells, and each cell two young seeds; but in obedience to the constant command of nature, one of the seeds grows faster than the rest, presses upon the other cells and seeds, gradually crushes them, till at last, when the acorn is ripe, all trace of them has disappeared.

The following are the most important of our California catkin-bearing trees and shrubs:

Beaked Hazel-nut (*Corylus rostrata.*) A common shrub, usually found on protected hillsides throughout the State.

California Chinquapin (*Castanea chrysophylla*). A mere shurb in the southern and central portions of the State. In Mendocino and Humboldt Counties it grows, however, to a tall forest tree, from fifty to one hundred and fifty feet high, and several feet in diameter.

White, or Weeping Oak (*Quercus lobata*). This species of deciduous oak is the most characteristic tree of our inland valleys. Its acorns ripen annually, and are usually quite large.

Black Oak (*Quercus Sonomensis*). A medium sized deciduous species of oak, usually found growing on sheltered hillsides, especially on the Coast Ranges. Its acorns are biennial.

Live Oak (*Quercus agrifolia*). A large evergreen species of oak, ranging from Cloverdale south to the Chuyamaca Mountains, in San Diego County. Its acorns are annual.

Mountain Live Oak (*Quercus chrysolepis*). A tall evergreen species, usually with gracefully weeping branches. It is generally found growing on knolls, or on the slopes of deep cañons or ravines. Its young leaves are golden yellow on the lower surface. Its acorns are annual.

Live Oak (*Quercus Wislizeni*). A medium-sized evergreen species of oak, resembling, at least some forms of it, very much, *Quercus agrifolia*, the live oak so common around the Bay of San Francisco. Its acorns, however, are biennial. It extends from Cloverdale northward into Mendocino and Humboldt Counties, and along the foothills of the Sierras.

Chestnut Oak (*Quercus densiflora*). A middle-sized evergreen species of oak, which is quite common in the Redwoods, but rarely met with on the Sierras. Its bark yields an excellent material for tanning. The acorns are biennial.

The numerous shrubby species growing in this State are omitted.

VII.—COMPOSITE FLOWERS (*Compositæ.*)

For the study of this difficult family of the vegetable kingdom, I recommend a plant quite common in our gardens in the autumn, the so-called French Marigold (*Tagetes patula.*) Its flower-head (fig. 1) is surrounded externally by an olive-green cup, formed of several bracts which have grown together at the edge (fig. 6); this cup is the involucre. Next the involucre are placed several florets (figs. 1 and 2), whose corolla is a broad yellow blade, rounded at the end, and striped with wide streaks of chocolate brown (fig. 2, *d*); it is all turned one way, spreading away from the flower-head, and only tubular at the bottom. Technically, they are named ligulate, which signifies strap-shaped, because in the greater part of composite flowers they are long and narrow; they are also said to form the *Ray* of the flower-head. At the base of the tube of the corolla you will find a few little narrow hairy scales (fig. 2, *b*), which stand on the top of the ovary, in place of the calyx. Botanists choose to call them the *Pappus*, although, in reality, they are the calyx which is only stunted and starved in consequence of its being developed amidst the constant pressure of the florets against each other. The pappus is often altogether absent, as in the Daisy, for instance; but it sometimes forms a beautiful plume of feathers, which catches the wind and enables the seed to soar into the air, and to scatter itself to a distance. The delicate feathery balls of the Dandelion, and some other closely related plants, are the fruit of that plant crowned by the pappus. Below the pappus is the ovary (fig. 2, *a*), containing a single ovule; it terminates in a slender style, which passes through the tube of the corolla, and forks at the top into two stigmas (fig. 2, *e.*) In time the ovary becomes a dry, hairy fruit (fig. 8), crowned with the pappus, and containing one single seed (fig. 9.) Such are the *florets of the ray.*

The middle of the flower-head (fig. 1, *b*), included within the ray, is called the *Disk;* it consists of florets constructed very differently from those of the ray. To examine them conveniently you should pull one of them out (fig. 3.) In the ovary you will find no difference worth naming; the pappus is also like that of the ray, only it is more perfect, and one of its scales is a sort of stiff bristle (fig. 3, *b.*) The corolla is of quite another kind; it is tubular from the bottom to the top; towards the top it widens, and at last separates into five little divisions, which are covered all over with hair in the inside; this kind of floret is called *tubular.* The stigmas are two (fig. 7), and project beyond the mouth of a little hollow cylinder, which is found at the orifice of all the tubular florets of the disk (fig. 4, *a.*) At first sight you may be at a loss to determine what the cylinder is; but if you use a magnifying glass, you will presently discover that it is formed of five anthers, which grow together by their edges, in the same manner as petals grow by theirs, when they form a monopetalous corolla. It is easy to split this cylinder (fig. 5), and then you will see that each anther has its filament, and two lobes containing the pollen.

The broad flat part, out of which the florets grow (fig. 6, *a*), is called the *Receptacle;* it is sometimes covered with scales, or hairs, or is even pitted with hexagonal depressions, which look like the cells of a honeycomb. The receptacle of a composite flower is nothing else but an expanded part of a stem. This receptacle has generally the property of opening when the florets expand, of closing when the corollas fall off, in

order to confine the young fruit; and lastly, of opening again and turning quite back to give more room to the fruit, which increases in size as it grows ripe.

Let us now pass from these considerations to a view of the sections into which the composite plants of California are divided, and enumerate such as may be easily recognized and readily procured almost anywhere in this State.

I *Section.—Tubulifloræ.* Corolla tubular in all the perfect flowers, regularly 5—rarely 3, 4—lobed, ligulate only in marginal or ray-flowers, which, when present, are either pistillate only or neutral (having neither stamens nor pistils.)

Solidago. Golden-rod.

Aster. Various indigenous species; some are also cultivated in gardens.

Bellis—Daisy. Common in gardens.

Helianthus—Sunflower. *Helianthus annus*, the common sunflower, will afford, on account of its large size, an excellent chance to study well the structure of composite flowers.

Maruta—Mayweed. Common on all roadsides.

Achillea—Yarrow. Common everywhere.

Tanacetum vulgare—Tansy. In gardens.

Artemisia—Wormwood. Many species.

Senecio—Groundsel. Many species.

Cirsium—Thistle. Many indigenous species.

Chrysanthemum. In gardens late in Autumn.

Cynara Scolymus—Artichoke. Most excellent to illustrate the structure.

II *Section.—Liguliflorœ.* Corolla ligulate in all the flowers of the head, and all the flowers perfect. Juice milky.

Cichorium Intybus—Chiccory. Cultivated.

Lactuca sativa—Lettuce. Cultivated.

Sonchus—Sow thistle. Waste places around dwellings and neglected gardens.

Malacothrix Californica.

Macrothynchus grandiflorus.

The last two named species are quite common early in Spring, and are often mistaken for Dandelions.

Composite plants should be studied in a pretty far advanced state only; the seeds should be nearly ripe.

If only one half of the enumerated species, so easily procured, are carefully analyzed and closely studied, the student will get a clear and definite idea of this most difficult family of plants.

VIII.—GRASS FAMILY.

One of the most common grasses of California is the Brome-grass (*Bromus virens*). It differs but little from the one represented in the plate (*Bromus mollis*). The California Brome-grass is an annual with an erect stem, about three or four feet high, and sometimes more or less covered with fine hairs. The stem requires more than mere external examination. Strip it of its leaves, so as to lay bare all its surface, and you will find it hard and thickened at every joint where a leaf has been torn off. Split it, and instead of the solid center of other plants, you will see that it is hollow, and consists of nothing but a cylindrical shell (fig. 2); at the joints, however, the sides of the cylinder meet and form a firm

partition, which completely separates one part of the stem from the other. It is this structure that renders the Bamboo so useful for forming cases to hold rolls of paper.

The leaves of the Brome-grass are hairy, narrow, and sharp-pointed at their lower end, which, notwithstanding its breadth, is considered to be their stalk; it rolls round the stem, forming a kind of sheath, which sometimes is not very easily unrolled. At the upper end of the sheath you may remark a thin white membrane, such as you have nowhere met with before. Botanists call such a membrane a *Ligula*. Thus far, then, we have two peculiarities in grasses: their hollow round stems, with partitions at the joints, and the ligulate leaves.

The flowers are still more unlike what you have before seen. At the top of the stem of the Brome-grass, a number of slender branches appear, turned chiefly towards one side, and by their weight giving a somewhat nodding appearance to the parts they bear (fig. 1); those parts (*a*, *a*, *a*) are oblong green bodies, apparently composed of scales, after the manner of a leaf bud; in reality they are little collections of flowers, whence they are named *Spikelets* (or *spiculæ* or *locustæ*, as they say in Botanical Latin).

Each spikelet is constructed as follows: firstly, at its base (fig. 3, *a*, *a*) are two green scales, each of which has about five ribs; these are the *Glumes*, strictly speaking; there is no trace of either pistils or stamens in their bosom; on the contrary, they are always found to be perfectly empty. When the glumes are removed, you come to some other parts, which, at first sight, look like glumes; but, on a more careful inspection, you will remark that they are composed of more scales than one, have a stiff bristle at their back, and contain some stamens and other parts in their bosom. These are called *Florets;* in the Brome-grass, there are about ten of these placed one above the other in two opposite rows (fig. 3, *b*).

Each floret consists of two scales called *Paleæ* (fig. 4, *a* and *b*), of which the more external (*a*) is the larger; it is covered all over the outside with soft hairs, and bears at its back, a little below the end (*c*), a stiff bristle, called the *Beard* or *Awn* (*arista*); the beard is in reality the mid-rib of the palea, partially separated and lengthened out. The inner palea (*b*) originates from above, and within the base of the outer is much smaller and more membranous, has its edges abruptly doubled inwards, and bears a row of stiff bristles on the angles (*d*) formed by the doubling. These two are the lower or outer, and the upper or inner, paleæ.

Next the paleæ come, on the side of the outer palea, two exceedingly small scales (fig. 5, *a*, *a*), which are much shorter than the ovary. They are called *hypogynous scales*, and are supposed to be the rudiments of a calyx or corolla.

From the base of the ovary arise three stamens (fig. 4), whose filaments are white, and so weak and slender that the long narrow anthers hang in a state of oscillation, in consequence of the inability of the filaments to support them.

The ovary is a wedge-shaped body, apparently consisting of nothing but pulp, and crowned by a tuft of long hairs (fig. 5); two styles, bearing singular brush-like stigmas, spring from its summit.

In this instance you have all the parts that are usually present in grasses, and you cannot avoid remarking how widely different the whole organization is from anything you have witnessed in other plants. The structure of the fruit is not less peculiar.

I have said that the ovary seems as if it were composed of nothing but pulp; it does, however, consist of an ovule and of a shell that includes it, but both are so soft that they grow together and cannot be distinguished. Immediately after the styles wither, the ovary swells, gradually loses its softness, and at last, when ripe, is nearly bald, having gained a sallow appearance, and become longer and thinner. At the period of maturity (fig. 6), there is still no means of separating the shell of the fruit from the skin of the seed, so completely are they grown together. The fruit looks, therefore, so like a seed, that it is no wonder that it should popularly be called so; it is better, however, to designate it a *grain*. If you crush the ripe grain you will find its contents of a hardish horny consistence, but easily reduced to a state of flour. From what you have seen in other instances, you will easily recognize this for albumen. Now, follow me attentively to find the embryo amidst all this flour. The ripe grain is much narrower at one end than the other, and more convex on one side than the other. Turn the grain on its flat side, so that the convexity is uppermost, and then carry your eye to the narrowest end; there you will espy a minute oval impression (fig. 6, *a*); if you carefully lift up the skin of this part, you will detect the embryo lying snugly half buried in albumen. It will appear like a greenish-yellow plano-convex oval body, in which you can discern no marks of organization. But if you will divide it perpendicularly with a sharp knife, you will then be able to see that it has a most complete and highly developed structure. You will find (fig. 7) that it consists of a thickish scale (*c*), upon which lies a little conical body (*a*), composed of several minute sheaths fitted one over the other; the scale is the cotyledon, and the conical body the plumule or young stem. At the lower end of the embryo may also be made out a sort of sheath lying within the extreme point (*b*). It is the rudiment of the root.

When the embryo first begins to grow, the cotyledon (*c*) swells a little and attaches itself firmly to the albumen by the whole of its highly absorbent surface; the albumen at the same time softening and becoming partially dissolved by the moisture it has taken up from the soil; by this means the nutritive matter of the albumen is conveyed into the cotyledon as quickly as it is formed. The radicle (*b*) is pushed downwards into the soil on one hand, and on the other the plumule rises upwards into the air; both these parts are abundantly supplied with the materials of growth by the cotyledon, until the roots have established themselves in the soil, and are able to pump up food for themselves and for the nascent stem. By the time this happens the cotyledon has shriveled up, the albumen is exhausted of its nutriment, and all these temporary parts cease to exist.

After the Brome-grass has been thoroughly studied, other accessible grasses should be compared with it. The following may be procured almost anywhere:

Red-top (*Agrostis vulgaris*); Canary Grass (*Phalaris Canariensis*). This may be readily raised from seeds. Orchard Grass (*Dactylis glomerata*); Kentucky Blue Grass (*Poa pratensis*); Low Spear Grass (*Poa annua*). This species grows in waste places, in streets, and in neglected gardens. Common Chess or Cheat (*Bromus secalinus*); Quaking Grass (*Briza maxima*); Timothy (*Phleum pratense*); Scutch Grass (*Cynodon dactylon*); Ray or Rye Grass (*Lolium perenne*); Darnel (*Lolium tremulentium*); Common Wheat (*Triticum vulgare*); Common Barley (*Hordeum vulgare*) Pampas Grass (*Gynerium argenteum*); Maize or Indian Corn (*Zea mays*).

LIST OF TEXT-BOOKS.

Reading.—McGuffey's Series, with Charts; Willson's Charts, where already in school.

Arithmetic.—Robinson's Progressive Primary, Rudimental, Practical, and High School; Colburn's Intellectual.

Spelling.—Swinton's Word Analysis.

Geography.—Monteith's Series, exclusive of the Introduction to the Manual.

Grammar.—Brown's Series.

History of the United States.—Swinton's Condensed School History of the United States.

Algebra.—Robinson's Series.

Natural Philosophy.—Hotze's First Lessons in Physics.

Penmanship.—Spencerian Series.

Physiology.—Cutter's Elementary; Cutter's Larger.

Drawing.—Walter Smith's Teachers' Manual for Freehand Drawing in Primary Schools.

RULES AND REGULATIONS OF THE PUBLIC SCHOOLS OF CALIFORNIA.

[Adopted by the State Board of Education, in accordance with subdivision one of section fifteen hundred and twenty-one of the Political Code, and required to be enforced in all public schools, according to subdivision one of section sixteen hundred and ninety-six of the Political Code.]

Section 1. Teachers are required to be present at their respective school-rooms, and to open them for the admission of pupils, at *fifteen minutes before* the time prescribed for commencing school, and to observe punctually the hours for opening and closing school.

Sec. 2. Unless otherwise provided by special action of Trustees or Boards of Education, the daily school session shall commence at nine o'clock A. M., and close at four o'clock P. M., with an intermission at noon of one hour, from twelve M. to one o'clock P. M. There shall be allowed a recess of twenty minutes is the forenoon session—from ten-forty to eleven o'clock—and a recess of twenty minutes in the afternoon session—from two-forty to three o'clock. When boys and girls are allowed separate recesses, fifteen minutes shall be allowed for each recess.

Sec. 3. In graded primary schools in which the average age of the pupils is eight years, the daily sessions shall not exceed four hours a day, exclusive of the intermission at noon, and inclusive of the recesses. If such schools are opened at nine o'clock A. M., they shall be closed at two o'clock P. M. In ungraded schools all children under eight years of age shall be either dismissed *after a four hours' session*, or allowed recesses for play, of such length that the actual confinement in the school-room shall not exceed *three hours and a half*.

Sec. 4. No pupil shall be detained in school during the intermission at noon, and a pupil detained at any recess shall be permitted to go out immediately thereafter. All pupils, except those detained for punishment, *shall be required* to pass out of the school-rooms at recess, unless it would occasion an exposure of health.

Sec. 5. Principals shall be held responsible for the general management and discipline of their schools, and the studies pursued; and the assistant teachers shall follow their directions, and coöperate with them, not only during school hours, but during the time when the pupils are on the school premises, before and after school, and during recesses. Assistants shall be held responsible for the studies, order, and discipline of their own rooms, under the general direction of the principals.

Sec. 6. Teachers are particularly enjoined to devote their time faithfully to a vigilant and watchful care over the conduct and habits of the pupils *during the time for relaxation and play*, before and after school, and *during the recesses*, both in the school buildings and on the playgrounds.

Sec. 7. It is expected that teachers will exercise a general inspection

over the conduct of scholars going to and returning from school. They shall exert their influence to prevent all quarreling and disagreement, all rude and noisy behavior in the streets, all vulgar and profane language, all improper games, and all disrespect to citizens and strangers.

SEC. 8. Teachers shall prescribe such rules for the use of yards, basements, and outbuildings, connected with the school houses, as shall insure their being kept in a neat and proper condition, and *shall examine them* as often as may be necessary for such purpose. Teachers *shall be held responsible* for any want of *neatness or cleanliness* about their school premises.

SEC. 9. Teachers shall give vigilant attention to the *ventilation* and *temperature* of their school-rooms. At each recess the windows and doors shall be opened for the purpose of changing the atmosphere of the room. Teachers are required to exercise reasonable supervision over the text-books of the pupil, to inspect the same from time to time, and prevent their defacement or wanton destruction.

SEC. 10. Teachers shall enter in the School Register, in the order of their application, the names of all those applying for admission to the school after the prescribed number of pupils has been received. Such applicants shall be admitted to seats, whenever a vacancy occurs in any class for which they have been found duly qualified, in the order of their registration.

SEC. 11. Teachers are authorized to *require excuses* from the parents or guardians of pupils, either in person or by written note, in all cases of *absence* or *tardiness*, or of dismissal before the close of school.

SEC. 12. No pupil shall be allowed to retain connection with any public school, *unless furnished with books, slates, and other utensils*, required to be used in the class to which he belongs; *provided*, that no pupil shall be excluded for such cause, unless the parent or guardian shall have been furnished by the teacher with a list of books or articles needed, and one week shall have elapsed after such notice without the pupil's obtaining said books. Books may be furnished to indigent children by the Trustees, at the expense of the district, whenever the teacher shall have *certified in writing* that the pupil applying is unable to purchase such books.

SEC. 13. Any pupil who shall in any way cut or otherwise injure any school house, or injure any fences, trees, or outbuildings belonging to any of the school estates, or shall write any profane or obscene language, or make any obscene pictures or characters on the school premises, shall be liable to suspension, expulsion, or other punishment, according to the nature of the offense. The *teacher may suspend* a pupil temporarily for such offense, and *shall notify* the Trustees of said action. Pupils shall not be allowed to remain in any of the rooms that are provided with improved styles of furniture, except in the presence of a teacher or a monitor, who is made especially responsible for the care of the seats and desks. All damages done to school property by any of the pupils shall be repaired at the expense of the party committing the trespass. Within one week of any damage to school property teachers shall notify the Trustees, or be held personally responsible.

SEC. 14. All pupils who go to school without proper attention having been given to personal cleanliness, or neatness of dress, shall be sent home, to be properly prepared for school, or shall be required to prepare themselves for the school-room before entering. Every schoolroom *shall be provided* with a wash basin, soap, and towels.

SEC. 15. No pupils affected with any *contagious disease* shall be allowed to remain in any of the public schools.

SEC. 16. The books used and the studies pursued shall be *such, and such only*, as may be authorized by the State Board of Education; and no teacher shall require or advise any of the pupils to purchase for use in the schools any book not contained in the list of books directed and authorized to be used in the schools.

SEC. 17. It shall be the duty of the teachers of the schools to read to the pupils, from time to time, so much of the school regulations as apply to them, that they may have a clear understanding of the rules by which they are governed.

SEC. 18. In all primary schools, exercises in free calisthenics and vocal and *breathing exercises* shall be given at least twice a day, and for a time not less than from three to five minutes for each exercise.

SEC. 19. The following supplies shall be provided by the District Clerk, under the provisions of section one thousand six hundred and fifty-one of the Political Code, on the written requisition of the teacher, viz: clocks, brooms, dusting brushes, wash basins, water buckets, tin cups, dust pans, matches, ink, ink bottles, pens, pen holders, pencils, crayon chalk, writing and drawing paper, hand bells, coal buckets or wood boxes, shovels, pokers, *soap*, towels, thermometers, door mats, and scrapers.

SEC. 20. Trustees are required to employ a suitable person to sweep and take care of the school house, and they shall make suitable provision for supplying the school with water.

SEC. 21. It shall be the duty of teachers to report to the County Superintendent the books used in their schools, together with the number of pupils in the several divisions of each grade. This report must be made at the beginning and close of each school session or year.

SEC. 22. The District Clerk, at the close of each term of school, or whenever a teacher is discharged, shall certify on the back of the order for the *last month's* salary that the State School Register has been properly kept.

RULES FOR PUPILS.

1. Every pupil is expected to attend school punctually and regularly; to conform to the regulations of the school, and to obey promptly all the directions of the teacher; to observe good order and propriety of deportment; to be diligent in study, respectful to teachers, and kind and obliging to schoolmates; to refrain entirely from the use of profane and vulgar language, and to be clean and neat in person and clothing.

2. Pupils are required in all cases of absence to bring, on their return to school, an excuse in writing from their parents or guardians, assigning good and sufficient reasons for such absence.

3. All pupils who have fallen behind their grade, by absence or irregularity of attendance, by indolence or inattention, shall be placed in the grade below, at the discretion of the teacher.

4. No pupil shall be permitted to leave school at recess, or at any other time before the regular hour for closing school, except in case of sickness, or on written request of parent or guardian.

5. Any scholar who shall be absent one week without giving notice to the teacher, shall lose all claim to his particular desk for the remainder of the term, and shall not be considered a member of the school.

6. Each scholar shall have a particular desk, and shall keep the same and the floor beneath in a neat and orderly condition.

INSTRUCTIONS TO TEACHERS.

1. Teachers will endeavor to make themselves acquainted with parents and guardians, in order to secure their aid and coöperation, and to better understand the temperaments, characteristics, and wants of the children.
2. Teachers shall daily examine the lessons of their various classes, and make such special preparation upon them, if necessary, as not to be constantly confined to the text-book, and instruct all their pupils, without partiality, in those branches of school studies which their various classes may be pursuing. In all their intercourse with their scholars they are required to strive to impress on their minds, both by precepts and example, the great importance of continued efforts for improvement in morals, and manners, and deportment, as well as in useful learning.
3. Teachers should explain each new lesson assigned, if necessary, by familiar remarks and illustrations, that every pupil may know before he is sent to his seat what he is expected to do at the next recitation, and how it is to be done.
4. Teachers should only use the text-book for occasional reference, and should not permit it to be taken to the recitation to be referred to by the pupils, except in cases of such exercises as absolutely require it. They should assign many questions of their own preparing, involving an application of what the pupils have learned to the business of life.
5. Teachers should endeavor to arouse and fix the attention of the whole class, and to occupy and bring into action as many of the faculties of their pupils as possible. They should never proceed with the recitation without the attention of the whole class, nor go round the class with recitation always in the same order or in regular rotation.
6. Teachers should at all times exhibit proper animation themselves, manifesting a lively interest in the subject taught; avoid all heavy, plodding movements, all formal routine in teaching, lest the pupil be dull and drowsy, and imbibe the notion that he studies only to recite.

RULES FOR DISTRICT LIBRARIES.

1. The Librarian appointed by the Trustees shall properly label and number each book in the district library, and keep a catalogue of the same, showing the title and number of each book.
2. The library shall be open for drawing and returning books [here insert such time as may be determined by the Trustees and Librarian.]
3. Every child attending school shall be entitled to the privileges of the library; but when the number of books is insufficient to supply all the pupils, the Librarian shall determine the manner in which books may be drawn.
4. No person shall be entitled to two books from the library at the same time, and no family shall draw more than one book while other families wishing books remain unsupplied.

5. No person shall loan a library book to any one out of his own house, under a penalty of fifty cents for each offense.
6. No person shall retain a book from the library more than two weeks, under a penalty of ten cents for each day he may so retain it; and no person may draw the same book a second time while any other person wishes to draw it.
7. Any person losing or destroying a library book shall pay the cost of such book and a fine of fifty cents; and any person injuring a book by marking, tearing, or unnecessarily soiling it, shall be liable to a fine of not less than ten cents, nor more than the cost of the book, to be determined by the Librarian.
8. Any person refusing or neglecting to pay any penalty or fine, shall not be allowed to draw any book from the library.
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Field's Rudiments of Color and Coloring.
Fowle's Teachers' Institutes.
French's First Lessons in Numbers.
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SPECIAL ARTICLES.

SCIENCE AS A PART OF TECHNICAL INSTRUCTION.

[From "Science for the People," by THOMAS TWINING.]

I have endeavored to show in the preceding sections: firstly, that workingmen are perfectly accessible to scientific knowledge, provided it be of a practical character, and offered to them in an easy and entertaining form; and secondly, that similar knowledge might in all probability be gradually instilled in an analogous form into the minds of the children of the people, as a part of their school education, by teachers duly trained for the purpose. The scientific knowledge referred to is that which I have found convenient to call Practical Bionomy, being common sense improved with scientific acumen, and made into a code for regulating the practical concerns of daily life, to the obvious benefit of the intellectual and spiritual ones. Such guidance no social class should be without, but least of all the workingman; not only because he cannot afford to make mistakes with his health or his money, but, also, because the amount of science, especially physics and chemistry, which forms the groundwork of Practical Bionomy, and the habit of turning scientific knowledge to practical purposes, may prove a valuable furtherance to him in mastering his trade. There are many occupations for which this small amount of elementary and practical science is abundantly sufficient, but there are many others which involve a considerable amount of scientific knowledge, whilst others again recognize art rather than science as their leading star. I will, for the present, confine my remarks to the scientific element in technical instruction, showing what I consider to be the chief desiderata, and in what manner I am endeavoring to supply one of them.

In the same manner that we have seen Practical Bionomy dividing itself naturally into two parts, the one more particularly devoted to elementary science, the other to the practical matters on which that science is to be brought to bear, so likewise do we find that the instruction required for trades involving scientific knowledge, separates itself into an elementary part in which the scientific teaching may be more or less the same for two or more trades, and a purely special or technical part.

Nothing is more useful for acquiring a clear notion of the parallelisms and divergencies of the various trades, and of the extent to which

young men in training for them may be taught together or must be taught separately, than to inscribe a number of trades more or less scientific, artistic, or manual, in the first column of a synoptical table, having another column for each branch of knowledge or attainment. In lately looking through some papers written about twenty years ago, when I was vainly striving with a few friends to raise the cry of scientific progress, I discovered among them the sketch of such a synopsis. It was never completed, but its framework remained in my mind, and has often rendered me great service in endeavoring to devise the means by which the greatest amount of sound technical instruction might be imparted with the smallest expenditure of teaching power.

One of the facts thus strikingly demonstrated, was the great predominancy of mechanical physics, chemical physics, and chemistry, among the scientific ingredients of technical instruction. It was evident that chemistry in particular ministers to a vast number of trades, of which some delight more especially in its metallurgical departments, whilst others less inclined that way, embrace in other directions a very considerable range of chemical science. I saw that among the latter category of trades, that of the dyer is particularly comprehensive in its grasp, and that if I could bring out a course of lessons calculated to satisfy the whole of its ordinary chemical requirements, I should include those of most other chemical (not metallurgical) trades. I felt that this would be a substantial ground of study common to the whole category, and that I should only have to add a certain quantum of special elementary and technical teaching for each trade, in order to give a practicle example of the manner in which I conceived that industrial studies should be carried on.

It is right to explain that the chemistry to which I here allude, is the practical and comparatively easy kind required by the working dyer, and not the higher kind of chemistry that should be possessed by the foreman of a large dyeing establishment. It is not necessary to discuss at present the various ways in which chemistry should be studied, according to the previous preparation of the student, and the purpose he has in view. It is obvious that in dealing with workingmen and lads brought up under the old educational system, and who are to take up chemistry with minds totally unprepared, one must absolutely set aside the *beau ideal* of the perfect science, and be only too glad if, by softening down certain difficulties and avoiding others, one can succeed in introducing into these untutored minds a tolerably complete and methodical sequence of sound facts and principles, calculated to render practical service. Such is the nature of the Elements of Industrial Chemistry comprised in the Twenty-four Lessons, the preparing of which has been my chief occupation for the last two years. Eight are devoted to inorganic, and sixteen to organic chemistry. I shall, perhaps, add a Twenty-fifth Lesson, for the purpose of giving to those who might be induced to pursue further their chemical studies, a few explanations tending to render less puzzling the use of the various handbooks written according to different systems.

It is right I should mention the following as circumstances that have mainly contributed to induce me to engage in this rather arduous undertaking. Firstly, the love for chemistry imbibed at an early age at Paris under Professor Orfila, and followed up whenever opportunities allowed; secondly, the loss of voice which during these last two years has favored the occupation of writing by checking other enjoyments; and, thirdly, the valuable assistance on which I could rely on the part of Mr. Hudson

who acts as the chemical superintendent of my museum. His critical and conscientious researches in scientific literature have been exceedingly useful to me in collating the best authorities on disputed points, and in collecting scraps of information required for my particular purpose, and not found in most of the treatises on chemistry. I also owe to his exertions in the laboratory, the neat and complete sets of illustrations, which have been packed by the Curator, Mr. Freeman, in appropriate boxes for circulation, and amounting in the aggregate to more than one thousand articles.

In the style in which these lessons are written and got up, they resemble the popular lectures, but they incline less towards recreation and more towards earnest study. They are shorter, being calculated to last about an hour if read by the same person who demonstrates, and considerably less in the binary mode of delivery. Thus time will be allowed for the students to question the teacher on any points they may not have understood, and for the teacher to precede each discourse by examining the students on the previous one. In short, the whole is intended to have the character of a regular and earnest series of class lessons.

Let us now consider this chemical instruction in connection with the other portions of instruction, elementary and technical, which, as I have said above, will be respectively required by the various trades. We have seen that the dyer is at the head of the chemical trades, and we may take his requirements as representing those of other members of the group.

The dyer, like everybody else, should possess that scientific knowledge, elementary and applied, which I have assumed to be the best secular key to health and comfort. I hope that in ten or twenty years hence, there will scarcely be a tradesman or artisan who has not acquired that knowledge, to some extent, in his primary education, and further developed it, with additions in a technical direction, during the important school period from twelve to fourteen; but, in the meantime, we must take tradesmen and their apprentices as the old system has made them, and I will select by way of specimen an ordinary dyer's apprentice, desirous of securing success in the practice of his trade by mastering its rationale. I first take the liberty of recommending to him my own course of "Science made Easy," not knowing any introduction to science on which more pains have been bestowed in order to conduct the beginner from the very bottom of the hill to a fair distance up it, without letting him feel that it is steep, or making him push his way through brambles, or causing him to tread on any unsafe ground. Our young dyer will find, what I have already asserted, that the elements of science required for daily life go a considerable part of the way towards meeting the requirements of technical industry, and he will do well to store in a handy corner of his memory, the physical laws illustrated in the first four lectures of my Popular Course. Lecture IV, in particular, will teach him much that is to his purpose, but not enough, especially as regards light. I have taken notice of the deficiency, and am, consequently, preparing supplementary physical lessons for the use of dyers, giving a tolerably full account of primary, secondary, and tertiary colors, complementary colors, harmony and contrast, and other matters, by the knowledge of which the dyer may be rendered an intelligent coadjutor, rather than a passive instrument of manufacturing industry on the one hand, and of fashion on the other.

I have alluded, in speaking of the manner of teaching science to

children, to the advantage of going two or three times over the same ground, and of adopting each time a further development of the subject proportionate to the mental development of the pupils. The benefits of this plan, of which I hope to say more elsewhere, are by no means confined to children, and the young dyer will not have any cause to regret having taken the rudiments of chemistry in two lectures (V and VI of my Popular Course), as a prelude to my Elements of Industrial Chemistry in Twenty-four Lessons. These latter I must ask him to go through in good earnest, as they are intended so far to complete the *first* or *elementary* part of his industrial knowledge, that he may be competent to study intelligently and scientifically the *second* part, consisting of applied and more strictly *technical* knowledge.

In order to secure for this important part of the dyer's studies, reliable information which might at the same time serve to exemplify in a practical way my proposed plan of instruction, I have had prepared by a person well acquainted with chemistry, materials for a series of lessons on the art of dyeing, embracing the following subjects: Historical Sketch, Textile Materials, The Dye House, Dyeing Materials, Dyeing Processes, Calico Printing, Cleaning and Scouring, and Special Pathology of the Dyeing Trade. These materials have already been submitted to a competent master dyer, and what remains to be done is simply to arrange them in lessons, similar to, and in strict accordance with, the chemical series.

I have likewise in hand, draft sets of technical lessons by the same writer, for the tanner and currier, and the plumber and glazier. The Popular Course as a first scientific foundation, and the Twenty-four Lessons Course of Industrial Chemistry as a more earnest insight into that most important science, will serve for these trades in common, but each will have supplementary lessons on any branch of elementary science that may be required, and each will conclude with its own special course of technical lessons.

If we pass to the mechanical trades, we find that there is everywhere scope for the same utilitarian principles of forethought, ponderation, and amalgamation: FORETHOUGHT, taking note of the items of knowledge that each trade is likely to require normally or incidently; PONDERATION, weighing these items against each other, that only the most indispensable may be recommended to those who cannot possibly be expected to learn all; and AMALGAMATION, uniting the studies, and consequently improving the resources for study, of the various trades, wherever they tread a common path. Thus the carpenter and joiner may find that the rudiments of chemistry given in my Popular Course, are sufficient for enabling him to understand any chemical expressions that may occur in his technical lessons; but, on the other hand, he must have a good insight into the manner of growth of exogens, and should know something of the nature and habitat of the chief timber trees, all which knowledge would be specially supplied. Then again his mechanical knowledge should be well developed, he should be well up in certain branches of arithmetic, and possess a few notions of geometry; and last, not least, his hand, his eye, and his judgment, should be duly trained in the appropriate departments of the arts of design.

It would be tedious to follow out with words, the exigencies of the various handicrafts, apportioning to each its proper kind and quantity of science and art, and taking note of the parallelisms which might enable a certain number of them to draw knowledge from the same source, and of the divergencies which would involve separate tuition.

The best, not to say the only way to arrive at a clear conception of those exigencies, is, as said before, to classify and tabulate them, and this is a labor that will be found well worth the while of those who aspire to establish with economy of means and certainty of results, a national system of technical instruction. But, at the same time, it must be borne in mind that this is only one of many points on which a careful investigation is indispensable, for safely legislating with a view to improve the intellectual, technical, and social status of our industrial population. Matters like these demand the concurrent efforts of many workers, and I intend to devote the next section of this Memorandum to an enumeration of points, on which I would suggest that communications should be addressed to the Society of Arts by all who, through special circumstances, are placed in a position to contribute reliable information and advice.

PRIMARY EDUCATION.

[From "Science for the People," by THOMAS TWINING.]

One of the first conclusions that were come to when the public mind adjured its apathy, and began discussing the subject of technical instruction, was that little headway could be made without first improving our system of primary education; and this latter branch of the subject has for various reasons excited so lively an interest, that it seems, at the present time, almost to monopolize public attention. I have not for so many years taken a lively interest in educational matters generally, both in this country and abroad, without acquiring rather positive opinions on many of the points which are now under discussion, but I see so much controversial acrimony mixed up in the debates that are going on, both orally and in print, that I feel averse to joining in them. My standpoint will be simply this, that whether the Union or the League should prevail, or whether a medium course should be adopted, I hope that the future system of popular education will be so devised and managed, as to include in its primary curriculum all the essential elements of the artisan's welfare, particular attention being paid to such points as the following:

FIRSTLY.—MORAL TRAINING. It should incorporate industrious habits and good conduct in the workingman's existence, as a part of his nature, and it should prepare him for mastering the difficulties of daily life, by making him master of his own mind. We are told by our worthy colleague, Mr. Bartley, who in the course of his highly praiseworthy educational investigations, has favored us with a valuable paper on the Birkbeck Schools, that in these, and notably in the one at Peckham, a moral tone prevails "considerably above that met with in most other schools." As these schools are strictly unsectarian, their mode of dealing with the moral element might be deserving of particular attention if the views of the League should prevail. That its partisans are by no means unaware of the importance of this point, is clear from the following passage in Mr. Bright's late speech at Birmingham: "In every school love of truth, love of virtue, the love of God, and the fear of offending Him, should be taught."

SECONDLY.—INSTRUCTION IN SCIENTIFIC AND PRACTICAL KNOWLEDGE. It has been seen by what I have said in the preceding sections, that the elementary and scientific instruction which I recommend as susceptible of being acquired without much difficulty by totally untrained adults, and with ease by well trained children, does not consist of any one whole science, but of a selection of the most simple, and, at the same time, most useful facts and principles of physics, chemistry, and physiology, with outlines of natural history; these various elements being arranged as a connected series, and brought to bear practically on the wants and resources of daily life. The greatest possible care and forethought should, of course, be bestowed on the choice and adaptation of this Primary Science, and, indeed, it should be so easy, and yet so useful, that future generations may wonder how people managed to get on so long without it. The first rudiments might be insinuated into the youthful mind at an early age, by exciting little curiosities which science might be made to satisfy, and by raising little difficulties which science might be made to overcome; and this plan should, as far as possible, prevail throughout; every available means of rendering the instruction visible and tangible, impressive and entertaining, being pressed into the service, so as to make scientific lessons a boon and a treat, never a bore. In going two or three times over the same ground the range of ideas would naturally expand each time, so that by the end of the school years, it might embrace in all essential particulars the scientific knowledge, both elementary and applied, which I have explained in Section 4; due regard being, of course, had to the sex and proposed career of the scholars, as well as to the limits of time and means. I am aware that to many of my friends it may appear somewhat utopian to speak of introducing science, even of the easiest kind, in the education of the people, whilst there are yet millions who can neither read nor write; but with such documentary evidence before us as that which, thanks to the enlightened exertions of Mr. Chadwick and others of our colleagues, has lately appeared in the columns of our journal, and when especially our reverend friend Mr. Rogers comes to us with the practical argument of youths leaving his admirable middle-class school at fourteen, with a knowledge of science and art, "that is not at present commonly attained, in the adult stages, in public schools, or in the most expensive private schools," there is no denying that a revolution is at hand in education, resembling in its results that which took place between thirty and forty years ago in locomotion. Independently of a considerable saving of time through the omission of whatever is not practically found to make children wiser or better, and through a judicious alternation of occupations, teaching power itself is undergoing a transformation which reminds us of the scientific substitution of steam for muscular power; whilst a judicious way of imparting knowledge that makes its acceptance spontaneous, is replacing the old plan of thumping it into boys' heads, somewhat as the system of smooth inviting rails replaced that of rough and resisting roads. Under such circumstances, I hope not to be far wrong if my calculations of educational progress suppose something like a railroad pace.

THIRDLY.—A FOUNDATION FOR TECHNICAL TRAINING. It has been shown that the scientific elements which are required for enabling a man to live judiciously, will go far towards enabling him to do his work intelligently. Any further knowledge more specially directed towards his intended occupation with which there may be an opportunity for endowing him, will, of course, be valuable, but here too the selection must be carefully made, for the nature of the knowledge will be of more importance than its amount. On the subject of the general value of scientific knowledge to the workman, and of the particular value of that which being thoroughly adapted to his needs will be sure to prosper, grow, and multiply in his mind, I may be allowed to quote from the discourse pronounced at the Plymouth School of Science and Art, by Bishop Temple, than whom no better authority in matters of education could be referred to. After alluding to the somewhat exaggerated dissatisfaction with our industrial status which supervened after the Paris Exhibition of eighteen hundred and sixty-seven, he acknowledges in

the following terms the good results which may accrue from a "grumbling spirit," when it becomes the source of active exertions:

"I have no doubt that in this way we shall really succeed in doing just what is wanted—that is, spreading over the whole of England that sort of knowledge of the principles of his work which is necessary to make a thoroughly intelligent workman, to provide everywhere the means by which any man, who has the ability to make himself master of those scientific principles on which all work must really be done, shall be able to cultivate the ability until he can rise very much above the mere routine rule-of-thumb workmen. * * * There can be no greater improvement to any one's mind than that he should thoroughly master the principles of his own work, that by which he is to live, that which is to occupy his time and his thought, that to which he is to give all the desires of his heart, the employment to which, if he is a thoroughly good workman, he would really wish to give a good and hearty service. All that really cultivates the man more almost than anything else you can teach him, for this reason: supposing you take a boy, and give him a great deal of careful instruction in something which he will never require, all he has learnt of it will gradually fade out of his mind. You will find, for instance, that those who have only been taught to read, and have afterwards had no inducement to read, by the time four or five years have elapsed, since they were at school, they forget how to read. The same is the case with almost everything else you can teach. In all instances it will be found the value of it is enormously increased—I do not say it entirely depends upon it—if the future life is a perpetual commentary on the early instruction. If a man learns that which in his work afterwards is perpetually occurring to his mind, his learning won't stop when he leaves school, it will go on and on, disciplining his intellect, opening his understanding, and the chances are that he will almost invariably add to the knowledge he had at first a great deal of additional knowledge, picked up he himself cannot tell how, simply because it is perpetually present to his mind, and his work perpetually brings it back. * * * He becomes a really better educated man, his intellect is more disciplined, he is in all his ways much more intelligent. I look upon it as one of the very greatest benefits that can be conferred upon a workingman that he should be enabled to cultivate his own mind; and the directest and easiest way to cultivate his mind is to enable him to acquire the principles of his own occupation."

A welcome confirmation of the value of mental culture to artisans, is afforded by Dr. Lyon Playfair's lately published powerful lectures on Primary and Technical Education. They are concluded by a condensed summary, from which I feel pleasure in quoting the following conclusions:

"That the limitation of the revised code to the three r's vulgarizes education, and renders it comparatively useless for the purposes of the working classes.

"That common sense, as well as the experience of other nations, indicates that an elementary knowledge of the principles of science and art involved in the occupations of the people should be introduced to primary schools, in order to make them a fitting preparation for secondary schools.

"That a higher education, in relation to the industries of the country, is an essential condition for the continued prosperity of the people; for intelligence and skill, as factors in productive industry, are constantly becoming of greater value than the possession of native raw material or local advantages."

Fourthly.—Manual Dexterity and Practical Cleverness. The example of what is done at some Industrial Schools, and especially those on the half-time system, shows that boys may attain a considerable amount of efficiency at manual occupations without detriment to their intellectual studies. It may frequently occur that a lad's parents cannot decide before the conclusion of his school years, what he is to be, and that he himself can scarcely make up his mind what he would like to be; but there are certain tools that every man should be able to handle, and certain trades that every artisan should know something of; and, moreover, there is a general cleverness of hand, as well as of mind, which will help a man on in almost every occupation that choice or circumstances may lead him to adopt. It is, perhaps, in respect of this general cleverness, which, with many, is a gift of nature, but which nearly all can acquire under a proper training, of this supple readiness for adapting muscular strength and agility to purposes not included in the ordinary routine of daily work, and of this presence of mind ever available for the impromptu application of knowledge to the overcoming of unforeseen obstacles, that the workmen of some foreign countries deserve our commendation, more than in respect of any technical capability that could be named. The success of our manufacturing industry proves that English workmen possess qualities of mind, and a temperament of body, which peculiarly suit them for discharging regularly and efficiently, under the guidance of intelligent foremen and enterprising manufacturers, a definite task assigned to them in the routine of factory work, and, generally, involving neither science, art, nor origination. The case is somewhat different with the tradesman or mechanic, who is expected to turn a ready hand to the various duties of a complex handicraft, who must rely on his own knowledge and ingenuity for helping himself under difficulties, and who cannot always, especially in the country, wait till a brother tradesman can come, and do some small fraction of his job, which protrudes beyond the regular frontier of his calling. Here we too frequently find shortcomings both as to technical knowledge, and as to the practical intelligence required for the ready application of that knowledge, shortcomings which occasion waste of expenditure, and annoyance and discomfort to the public, whilst they entail unnecessary trouble, and oftentimes injury to health or limb on the artisan himself. This is by no means to be wondered at, considering, on the one hand, the lax and deficient system of technical training which has hitherto, generally, prevailed—deficient in the amount of knowledge imparted, and lax in its selection; and, on the other hand, the absence, among a large portion of the work-payers, of that scientific knowledge which would make them alive to, and impatient of the ignorance of those whom they employ.

Fifthly.—Art Training. The workingman's education is so much a battle against time, that I cannot agree with those who would make freehand drawing an essential item in nearly all popular education. There is a certain training of the eye to understand what is meant by a

painting or a print, to appreciate the difference between a good picture and a daub, and to be capable of selecting cottage ornaments not deserving of a place in the "chamber of horrors," which I should wish every sane and seeing individual in the United Kingdom to possess; but manual ability at any branch of the arts of design, unless it be a natural gift in a very exceptional degree, is not to be acquired without much time and teaching. I should not be true to the utilitarian spirit in which I should wish the education of the people to be organized, if I were to recommend that every plowboy should be taught to draw; but, on the other hand, no one appreciates more than I do the value of the arts of design for all artisans whose handicrafts involve origination, or a taste for execution of the designs of others. The carpenter or the cabinet-maker taking orders for a Summer-house or a secretaire, should be able to sketch the proposed article, either in perspective or isometrically, *et sic de cœteris;* each artificer being trained in that particular direction which he is likely to require, and receiving a quantum of artistic taste into the bargain. Passing thence to the province of art-workmanship, we rise by degrees till toil involves no bodily fatigue, and the artisan is merged in the artist. I cannot pass by this industrial region, in which we used formerly to shun comparison with other nations, without paying my humble tribute of admiration to the highly successful exertions of our friend and colleague, Mr. Henry Cole, whose system of art training has extended its benefits to all parts of the country, making them all contribute in return their respective quota to the national stock of artistic talent.

Perhaps some member of our society may be inclined to ask how it is that, notwithstanding the remarkable impulse thus given of late years to the applications of the arts of design to industrial purposes, we read in the *Society of Arts Journal* of the fifth of March, eighteen hundred and sixty-nine, so discouraging a report addressed to the Council by the three eminent men who had undertaken the office of judges in the competition of art workmen for the society's prizes. As long as the supplying of model designs in the several branches of art industry had formed part of the system of our yearly special examinations, we had had every reason to be satisfied with the ability displayed by the respective candidates in carrying them out; but the attempt to raise our art workmen a step higher by inducing them to be the executors of their own designs, led to the results depicted as follows in the report:

"In spite of the individual specimens of excellence to which we shall presently allude, we are bound to confess that the response made by art workmen to the society's liberal invitation to compete for prizes offered during the last session, cannot, in our opinion, be regarded as satisfactory. It will be remembered that the lists of subjects proposed differed materially from those of previous years—it having been considered well, as an experiment, to test the workmen's powers in the combination of original design with skillful workmanship, and in novel directions rather than to keep them in the groove of the reproduction of the best works of the past. * * * Whether it is that the task recently set to the art workmen has been beyond their present powers, or, as is more probable, that they look with anxiety only to what affects their regular employment, possibly, in some cases, apprehending notoriety as a fault rather than merit in their masters' eyes, certain it is that the results of their labor, taken as a whole, are not such as we had hoped for, nor such, by any means, as we think would have been made

by French, or even by Belgian workmen, had a similar invitation been addressed to them. We do not necessarily attribute this to incapacity on the part of our art workmen as executants, but ascribe it rather to their want, in this case, of the directing and sustaining power which is supplied to them, in the course of ordinary business, by the superior education and attainments of their masters, and of the artists and designers, from whose drawings, models, or suggestions, they may habitually work."

Now, I perfectly concur in thinking that our comparative failure in the endeavor to elicit tokens of origination from our art workmen, is in great measure to be attributed to the simple fact that origination is not what their employers particularly wish them to possess; and I can perfectly follow out in my mind the hint given us by our Art Judges that "notoriety," or in other words distinguished excellence in design on the part of a workman, might not exactly please a master who required merely a perfect instrument, patient, opinionless, and not possessing any merits beyond those absolutely wanted. But it is certainly not for meeting such views as these that our educational system is to be organized, and I delight in the expectation that the measures which will, in all probability, be adopted, for giving the children of the people a primary schooling better calculated to awaken their intelligence, will, in process of time, tell very effectively on their aptitude to turn to good account the facilities for artistic instruction which Mr. Cole has placed within their reach. I am not a believer in panaceas, and do not argue that science will make a lad an artist; there is, on the contrary, a kind of science and a way of teaching it, more calculated to deaden than to improve the poetic sentiment which should pervade his appreciation of the chaste and beautiful in art; but, I firmly believe that, science so selected, and so taught, as to raise the youthful mind towards heaven in thankfulness for God's bounties, and, at the same time, to awaken it to an intelligent and lively use of them, is the most effective drilling that the mind can have for the development of its highest, as well as of its most practical faculties. When science of this kind shall have opened the understanding, and elevated the aspirations of the children of the people, we shall not see our soldiers hungry and shivering where a French campaigner would contrive to make a comfortable meal, neither shall we see our art workmen unable to compete with their neighbors in thought and origination.

Sixthly.—Music and Poetry. Among the humanizing influences of which primary education should prepare, and, if possible, initiate the development, an honorable place belongs to Music, and to this all will agree who have watched the endeavors made to promote choral societies in this country; but I would refer them to Switzerland, the Tyrol, and other parts of the continent, for more complete ideas of the manner in which part singing may be introduced with success at an early age, so that it may expand into a popular resource, and become one of the best preservatives against the abuse of stimulants. The theory and practice of music were among the favorite pursuits of my younger days, and I shall have many suggestions to offer on this subject, should I ever reach the portion of my Popular Course intended to embrace the recreations of the working classes. As regards poetry, I have, perhaps, raised a smile by naming it with music at the head of this paragraph, as one of the matters to be considered in devising a scheme of popular elementary education. Now, I do not wish to train any one to

verse making, who is not born a poet; no practice is more unpractical, nor need we recur to the testimony of Horace to know that day dreamers are likely to fall into a well. But there is an immense difference between poetizing, and possessing that faculty of poetic feeling which gives us the perception and the enjoyment of what is noble or touching in a moral sense, sublime or beautiful in nature, masterly in art, or admirable in literature. It is this feeling which I should wish to see infused wherever practicable into the nascent energies of youth, in close companionship with moral sentiment; not didactically, for that would be a failure, but by the thousand means of gradual infiltration which a well ordered education, even that of the humbler classes, can generally command; and I should particularly wish this æsthetic development to be attended to in the rather higher stages reached by those intending to become art workmen. Nothing would tend more effectually to make up for the want of a southern sky, than the brightness of conception which poetic feeling can impart.

SEVENTHLY.—RECREATION, EXERCISE, DRILLING. Whilst, on the one hand, no part of the proposed primary science teaching should be a hardship, and many parts a treat, a favor, and a recompense; on the other hand, recreation should never be mischievous but often instructive. To enumerate the many ways in which games and pastimes in and out of doors may be made to contribute to the development of bodily strength and agility, of a quick intelligence and a ready memory, of courage, perseverance, conscientiousness, good nature, and good manners, would be to add at least a score of pages to this Memorandum. Particularly deserving of notice, however, is the subject of Drilling and Military Exercises, which, independently of their value with a view to our possessing an efficient and spirited system of national defence, more or less analogous to that of the Swiss, are susceptible of promoting very essentially the love of order, and that sense of honor which says so emphatically—"Act on the square, boys, upright and fair."

DRAWING IN THE PUBLIC SCHOOLS OF THE CITY OF BOSTON.

[A lecture delivered before the students of the Massachusetts Normal Art School, on Thursday, February 26th, 1874, by WALTER SMITH, Art Master, Director of the school, and State Director of Art Education in Massachusetts.]

There is a general impression that the study of Art is helped or hindered by the method upon which it is pursued, and that in the European schools those which have succeeded the best owe success to their arrangement of the exercises, rather than to any external influences.

General education in art is too recent an experiment in all countries for the question of methods to be definitely settled, so that in America we are not far behind the pioneers, and may yet be permitted to achieve the proud position of leaders, who have deliberately graded the subject and adapted it to the capacities of pupils of all ages, applying its results to the wants of all occupations.

Before the world is fifty years older, technical education in art and science will be considered as of equal importance with any that can be given in the universities, both from its actual usefulness to society and from the luster it confers on a people; as distinct in its influence as the invention of printing, and having a somewhat similar effect upon general education; whilst its fruitfulness in the increase of wealth arising from more highly skilled labor, and the opportunities it will offer to the inventive, will tend to bring it into the front rank as a profitable and practical sort of education.

Art education, and even the teaching of drawing, has been so long considered as a mere plaything, that it is very rare to find people intelligent enough to see its bearing as the most practically useful of all studies in relationship to the industrial products of a people; and still rarer is it to discover a man who is so intimately acquainted with its educational processes as to see the important bearing which education of the eye and skill of the hand must have on all other studies.

It may, however, be asserted that nothing so develops the observing faculties as the practice of accurate delineation, arising from close scrutiny of external forms, and analysis of the causes from which they result.

Commend me to the man or woman who has drawn many things well, for a description of anything that has existed or happened within range of their eyesight.

We have not yet begun to realize the effect which systematic drawing will have upon all education, still less have we foreseen the greatness and value of the artist of the future, in a country where all people are artistic. The very essence of the art education we are endeavoring to develop here is its practical value in industry, its useful influence on general education, and its foundation for future attainments, by the few, of the highest success in fine art. Note the order in which these objects

are stated: First, the improvement of industrial art; second, the development of powers of observation and accuracy in general education; third, opening the way for the few great souls who will win honor and glory for their country in the world of art.

If the establishment of mere fine-art academies were the end sought for in the present movement in favor of art education, we could perhaps do no better than copy several ancient and time-honored schools in other countries; but the fostering of professional education in art is not the object of our work, and if we seek for a precedent which includes all the aims attempted in our own scheme, we shall seek in vain. So that, although many nations and countries have attempted and attained to success in branches of this broad subject of art education, none has hitherto made so great and wide an experiment as we are endeavoring to carry out here in this State of Massachusetts to-day.

For this reason, though we are bound to look with respect to the systems and methods of art culture practiced in other countries, we cannot regard any as complete or as having a perfectly comprehensive basis; and I hope that we shall be able to contribute as much towards the creation of a comprehensive scheme of art education as will enable us to repay the pioneers of other lands for the experience they have placed at our service, by showing them some original developments here.

That you may all know something of the standard of education which we are endeavoring to work up to in the public schools, I propose to describe to you the programme of the Boston schools in the matter of drawing, and though I cannot say that it is being perfectly carried out in all the schools, it is only a question of time when that shall be done; the fact that already in many schools it is in full and successful operation proves beyond all question its possibility, and makes it but a matter of months as to its equally satisfactory working in all.

This part of the subject is of the highest importance in your own education, for two reasons: the first, because it will show you how general must be your own attainments when elementary instruction includes so much; the second, because, this school being the pioneer training-school for art teachers in the United States of America, you will probably be sought for by other cities and States, near or distant, to organize instruction in drawing for their public schools, when your own education has been completed here. And it may be that your acquaintance both theoretically and practically with the public-school system of Boston will be as valuable to you in the future as it will be beneficial to the schools placed under your charge.

The schools are of three classes: 1. Primary; 2. Grammar; 3. High Schools.

PRIMARY SCHOOLS.

Between the ages of five and nine, or five and eight, it is not possible to develop much skill of hand, but quite easy to teach a good deal about drawing, and give information concerning names of lines and forms that will serve as a basis of much future knowledge. The time devoted each week to drawing is two hours, and the number of lessons four, of thirty minutes each. Perhaps six lessons of twenty minutes each would be an improvement on this; but if the full weekly time of two hours be given, it should always be left to the teacher in exactly what length of lesson to devote the time. The idea of the lesson for young children is that it should be short and sparkling, never long and monotonous, and

this has governed the character of the subjects taught. No two lessons consecutively given are to be on the same subject, in order that the interest of the children be maintained by the novelty of the lesson. Thus a simple outline of an object or flower or leaf is drawn on a large scale by the teacher on the blackboard, the children following her step by step, drawing on their slates as she draws on the board. A second lesson is given differently; a card on which simple forms are printed is put into the hand of each child, and the exercise is to draw the forms on a larger scale upon the slate, the teacher illustrating the mode of procedure by sketches on the blackboard.

If you, who are already teachers of drawing, want to see beautiful teaching, go into any primary school in Boston and ask to be allowed to be present whilst the drawing lesson is given. The teacher has to depend so much upon personal influence, and has to simplify and emphasize the directions so thoroughly for very young children, that the lessons given are, as a rule, beautifully clear and instructive.

Other subjects are memory drawing and drawing from dictation, which may be described as reproducing what you know of a form, or reproducing what you imagine a form is, from description given. Of course both of these exercises have to be of the simplest kind, and all complications and hard words avoided; but it is quite astonishing how forms may be fixed in the memory so that they can be reproduced at any time, and also how children, when very young, can be made to draw that which they never saw, from the mere verbal descriptions of the teachers. The learning of terms and definitions of geometric forms accounts for much of this, for children may as easily be taught the name of square, diameter, and diagonal, as the names of apple, orange, bureau, corner, mantle, etc.; and when the terms which describe certain forms are impressed on the memory, it becomes as easy to draw the visible shapes they represent as it is to call out their names when the form is displayed to the eye.

In the Primary Schools there are six classes, and the four lowest draw entirely on slates, both for the sake of economy and to give confidence and freedom to the children. In the two higher classes they draw on paper what has been previously done on slates, so that they learn one thing at a time in both the divisions. We assume that a child's understanding has to be reached by lively descriptions and sketches on the board, which he tries on his slate to embody, before he ought to be laden with the difficulty of using the lead-pencil and paper. Then, when he has got the right idea, we try to teach him to express it in a more permanent way on paper, thereby building up a habit of care and observation at the same time; for he has to think twice before drawing once, when every error bears witness of mistakes.

The most elementary form of inventive design is also practiced in the higher classes of the Primary Schools, usually the filling of squares, triangles, and circles with simple combinations only; almost anything to exercise the inventive faculties without overloading them. In this Primary-School work great accuracy is not sought for, because it is impossible to get it from such young pupils, and my cry to the teachers has always been: "Be merciful to the little folks, and don't expect perfection in their work." If they can learn something and be amused and interested each lesson, their future will exhibit development in drawing as in other subjects. I should as soon think of trying to make a baby sing accurately, instead of crowing victoriously, as to find a child drawing accurately, when I expect to see the most delightful of

caricatures. The work to be done in Primary Schools is to teach names, exercise the fingers, and make the poor little things as happy as possible in the mill which civilization places them in.

I am sometimes asked, Why should such young children be taught to draw, if it is impossible for them to learn to draw well? and my answer is, that drawing, like the wearing of boots, is a purely conventional practice, and the longer you put it off the harder it will be to you when you take to it. It is just as easy to bring your hand into subjection as your foot, only the sooner you begin the better. It is, as our friend Mr. Murray expresses it, like mouthing a colt, or rather letting him do it himself, by gentle degrees, so that there may be no cruelty in the operation.

It is not as though drawing were an exercise of the reasoning faculties, which would make it a heavy task to little children; it is only the most natural indulgence of their imitative faculties, and something which, properly taught, they delight in as being some of the biggest fun in the world.

GRAMMAR SCHOOLS.

In the Grammar Schools for the present we expect to be able to teach three subjects well, viz.:

1. Freehand outline drawing and design.
2. Geometrical drawing of plane figures.
3. Model and object drawing.

The classes are graded into two groups, the three lower being one group, and the three higher form the second.

In the three lower classes all that has been learned in the Primary Schools is applied to the two new studies, geometrical drawing and model drawing.

The course of geometrical drawing includes about one hundred and fifty problems and exercises, and the three lower classes will eventually get through about seventy-five of them. These are all of a very simple character, such as the bisection of angles, the construction of squares, etc., all of which the pupils have frequently done before by freehand, and cannot therefore find it difficult to do with rule and compass.

In model and object drawing the pupils of the lower group draw from the blackboard examples given by the teachers, accompanied by explanations of the principles by which solids may be represented. So that, before drawing a cylinder from the real object, he is taught the rules by which alone cylinders can be represented.

In this connection let me say that I have found, after many years of experience, that the easiest and most successful way of teaching model drawing is to confine the first practice to round or curved forms only, such as fruits, vases, and objects whose outlines will be mostly curved lines. Thus all objects made on a potter's wheel, and all that have been turned in a lathe, in fact, every object which has a circular form in its section, is suitable as an example to begin with in drawing from the solids; whilst all forms whose outlines are straight lines, as those of a box or cube or prism, will introduce the convergence of parallel lines, and all the difficulties of perspective.

The two rules that have to be learned in model drawing, are first, *a circle seen in perspective appears as an elipse;* second, *parallel lines retreating from the eye appear to converge.*

Now for drawing apples, oranges, vases, teacups and saucers, cylinders, cones, etc., the first rule applies, and gives us practice in which one principle only has to be remembered; but in drawing the outlines of books, chairs, cubes, prisms, and objects bounded by planes, the second rule comes into play, and it is a long and tedious task to convey to the pupil the infinite variations and applications of this law. So that our first practice lies in the drawing of forms which are round, and the pupil is taught to see proportion and express it with as little of the mysteries of perspective as need be, reserving that for work in the higher group of classes in the Grammar Schools.

In the same way every pupil is expected to make a design in outline of ornament once a week or once a fortnight, the lower group in pure outline, and the higher using a tinted background, if desirable.

This is one of the developments of art education, the credit of which I claim for the American school, because it has originated in them, the public schools of no other nation in the world having this exercise, from the lowest class to the highest. And the same may be said for drawing from dictation. We have invented those two exercises in Boston schools, and mean to hold fast to them; and I claim for them, as features of a system of drawing, a greater importance than can be claimed for anything previously invented in this or any other country to develop art power.

But the design of pupils of Grammar Schools is necessarily the adaptation of old materials in the lower classes, though in the higher classes original designs are frequently produced.

We expect no more originality of design from the children than we get from professional designers whose work is principally the adaptation or arrangement of old forms to new purposes; but we expect as much novelty in these transpositions and transformations, and get it from the children as often as from the adults.

Having learned about the principles of model drawing in the lower classes, the higher classes begin to draw from the actual solid, first of single objects, then in groups of two or three, following the same order of subjects as in the lower classes, namely, round forms first, and flat forms secondly.

Occasional lessons are also given in memory, dictation, and map drawing, to keep up the knowledge given in the Primary Schools; but the three strong and essential subjects pursued in the Grammar Schools are freehand drawing and design, geometrical and model drawing.

That good work is being done in these subjects I have brought here to-day for your inspection the books used in one of our Grammar Schools. Compare this work with what you did yourselves when in Grammar Schools as pupils, and it strikes me you will say the world is not a stationary body.

Yet you must remember that we have only very recently begun this scheme, and what we have attained already is but a very faint foreshadowing of the results a few years will unfold. When the children at present in our Primary Schools have passed through the Grammar Schools, then we shall have work to show which will be as superior to this as this is to anything preceding it. Ultimately we expect to teach the elements of parallel and angular perspective in the Grammar Schools.

HIGH SCHOOLS.

In the High Schools, taught by special and professional teachers of drawing, we should have the full fruition of our scheme, and doubtless there are very excellent drawings made in them. Nevertheless their present attainments are greatly limited by the imperfect preparation of the pupils in the Grammar Schools, before the subject of drawing was taken up so seriously. And there can be no better proof of the value of beginning early than one fact which the last exhibition of drawings in the Boston schools developed. The elementary designs from the High-School pupils were not as good as those sent by any of the Grammar-School classes, and the teachers to whom I applied for an explanation said that design was harder to their seventeen-year-old students than any other subject, whilst the Grammar-School teachers told me, on the other hand, that it was the easiest and most interesting of all subjects to their pupils, varying in age from eight to fifteen. The High-School pupils had evidently begun too late.

In the High Schools we have at present to teach geometrical drawing, because it was not taught last year in the Grammar Schools; but this subject will eventually be replaced by perspective.

The changes from Grammar-School work to High-School work are as follows, viz:

1. Perspective takes the place of geometrical drawing.
2. Cast drawing and drawing from natural objects succeed drawing from geometrical solids.
3. Applied design for objects of industrial manufacture takes the place of elementary design.

In the High Schools the study of light and shade, painting in colors, the study of botanical forms and of historical ornament, are also pursued, or will be as time goes on.

In the advanced classes of the English High School we have mechanical and architectural drawing taught very successfully also, and eventually the individual requirements of each pupil will be attended to, and technical subjects be extensively taught.

You will observe that as we ascend in the scale of schools, the more difficult is it to secure the application of our scheme, for want of previous preparation in the elements. This is a difficulty every day and every hour are doing their share in removing, and in the course of three years at the furthest we shall have in operation throughout all the schools a graduated course, in which no one step will be found difficult, which begins as far back as it is possible to go, and ends with practical preparation for the business of life and its enjoyments also.

This is what we are endeavoring to attain in the three great divisions of the schools:

In the Primary Schools, to learn the names of forms and know the difference between one shape and another, and have a childish knowledge of the use of lines. I heard a six-year-old boy from one of our Primary Schools explaining to a middle-aged carpenter the distinction between a vertical line and a perpendicular line, a few days ago, and it was evidently new light to the carpenter. Said the boy, taking up the carpenter's square and placing one of its arms on a level table, making the other arm vertical, "You see this upright line is vertical now;" (then tilting it up) "now it is n't; but in both positions it was perpendicular to the other half of the square."

I thought that drawing is going to do something for the rising generation besides amusing them, if that boy is a fair specimen of six-year olders.

In the Grammar Schools, both the names of forms and power to reproduce them will be acquired, and ability to draw from flat and solid anything not of a very complex character. To be able to draw with geometric accuracy any geometric form, by use of instruments, and to design ornamental combinations of old or new patterns, displaying a fair amount of skill in original work.

In the High Schools, to apply this skill in design to practical purposes. Thus we have this year given as exercises in design to the High Schools the following subjects:

1. Design for an encaustic tile.
2. Design for a wall paper.
3. Design for a lace collar and cuffs.
4. Design for a center-piece of a frescoed ceiling.
5. Design for the border of a porcelain plate.
6. Design for the shape of a pitcher, ornamented by horizontal bands of enrichment.

Thus we ally the education given in the public schools with the progress and elevation of industrial art, for it will be impossible that the graduates of our High Schools will purchase worse designs than they could make themselves, and this intelligent demand for good art workmanship on sound principles will soon be reflected in its supply.

The High Schools, also, will eventually prepare for us designers who are not imitators only; for a definite percentage of well-educated people will inevitably become artists, architects, or engineers, and designers for industrial products.

What we want to grow we must plant in the seed, and though we cannot make design grow in all minds, we can plant the seed and protect the growth where it does take root, ultimately rejoicing in the flower which rewards our care and watchfulness, the blossoming forth of originality and unfolding of hidden beauties.

The plan of instruction upon which the Boston schools are being taught this year is given in *Appendix A*.

That you may also know what is being attempted in the Evening Classes, I give (*Appendix B*) the "Scheme of Instruction for the Study of Industrial Drawing," adopted by the School Committee of the City of Boston, and also (*Appendix C*) suggestions occurring in my State report whereby this scheme may be applied in all the cities of the State. So that, whilst studying in this school to become teachers of drawing, you may see what is already being done towards developing art education by some of those who are appointed to instruct you.

APPENDIX A.

Plan of instruction in drawing for the Public Schools of the City of Boston, for the year eighteen hundred and seventy-three–seventy-four.

Schools.	Classes.	Time given per week.	Number of Lessons per week.	Length of Lessons.	Drawing on—	Taught by—	Subjects taught, Order of Lessons, and Text-Books to be used.
1. Primary Schools.	6, 5. 4, 3.	Two hours	Four.	30 minutes.	Slates.	Regular Teachers.	Subjects Taught....Freehand Outline from Cards and Blackboard. Memory Drawing. Dictation Drawing. Definition of Plane Geometry to be committed to memory and illustrations drawn. Order of Lessons...1. Enlargement from Cards. 2. Reduction from Blackboard. 3. Memory and Dictation Drawing alternately. 4. Geometric Definitions. Text-Books ....For Teachers.—Manual of Freehand Drawing for Primary Schools. For Pupils.—American Drawing Cards. First Series, Classes 6 and 5. Second Series, Classes 4 and 3.
	2, 1.	Two hours	Four.	30 minutes.	Paper in Books.	Regular Teachers.	Same subjects with addition of object lessons and linear design. Same order of lessons; same Text-books, but the pupils draw on paper instead of slates.*
2. Grammar Schools.		One hour and a half.	Three.	30 minutes.	Text-books.	Regular Teachers.	Subjects Taught....Outline of Ornamental Design and of Objects. Map Drawing. Memory and Dictation Lessons. Geometrical Drawing. Order of Lessons...1. Freehand and Design alternately. 2. Memory and Dictation alternately with Object Drawing. 3. Map Drawing and Geometrical Drawing alternately. Text-Books ....For Teachers.—The Teachers' Manual of Freehand Drawing and Design. For Pupils.—The American Text-Books of Art Education.
	6................	....	....	....	....	....	................No. 1. Freehand Book. No. 1. Geometry Book. Model Drawing from the Blackboard.
	5................	....	....	....	....	....	................No. 2. do. do. No. 1.* do. do.
	4................	....	....	....	....	....	................No. 3. do. do. No. 1.* do. do.
	3................	....	....	....	....	....	................No. 4. do. do. No. 1.* do. do. No. 1.* Model Book.
	2................	....	....	....	....	....	................No. 5. do. do. No. 1.* do. do. No. 1.* do.
	1................	....	....	....	....	....	................No. 6. do. do. No. 1.* do. do. No. 1.* do.
3. Latin and High Schools.		Two hours	Three.	40 minutes.	Text-books.	Regular Teachers.	Subjects Taught and Order of Lessons. 1. Freehand Drawing and Design. 2. Model Drawing. 3. Geometrical Drawing. 4. Special Studies. Text-Books ....The American Text-Books of Art Education.
	Third Class, or *Juniors*.	....	....	....	....	....	................Nos. 4 & 5. Freehand Book. No. 1.*Geometry. No. 1.*Model Book.
	Second Class, or *Middle*.	....	....	....	....	....	................No. 6* do. do. No. 1.* do. No. 1.* do.
	First Class, or *Seniors*.	....	....	....	....	Special Teachers.	................Model Drawing and other subjects chosen by instructors, copies from the solid or nature.
4. Normal School.	All the classes.	Two hours	Two.	60 minntes.	Text-books.	Special Teachers.	Subjects Taught and Order of Lessons. 1. Freehand and Design. 2. Model and Object Drawing. 3. Geometrical. 4. Perspective Drawing. Text-Books Used....American Text-Books of Art Education. Nos. 1 to 6.

The principals of High and Grammar Schools will see that each teacher is supplied with the books required for the class, according to the programme now issued.

In case any teacher may feel incompetent to teach drawing in his or her classes, the Normal Art Classes are open, in which the instruction may be obtained to fit a teacher for the work required.

* Used temporarily until the classes have completed the elementary work, when the subjects will be graded for each class, as is done in the case of Freehand Drawing in the Grammar Schools. When the first books are completed each class will be advanced.

APPENDIX B.

Scheme of instruction for the study of industrial drawing in the Free Evening Classes of the City of Boston.

STAGES AND SUBJECTS OF STUDY.

ELEMENTARY COURSE. From Copies. ADVANCE COURSE. From the Real Object or Design.	*Stage I. Instrumental Drawing.* Sections: *a*, Linear Geometry; *b*, Mechanical and Machine Drawing; *c*, Linear Perspective; *d*, Details of Architectural Drawing and Building; *e*, Ship-Draughting.
ELEMENTARY COURSE. Outline.	*Stage II. Freehand Outline Drawing* of Rigid Forms, from Flat Examples or Copies. Sections: *a*, Objects; *b*, Ornament; *c*, Flowers, Foliage, and Objects of Natural History; *d*, The Human and Animal Figure. Mediums used: 1, pencil; 2, chalk; 4, ink. *Stage III. Freehand Outline Drawing*, from the "Round" or Solid Forms. Sections: *a*, Geometrical Solids, Vases, etc.; *b*, Ornament from the cast; *c*, Flowers and Foliage from Nature; *d*, Details of the Human Figure, and Animal Forms from the cast. Mediums used: 1, pencil; 2, chalk; 4, ink or sepia.
ADVANCED COURSE. Shading.	*Stage IV. Shading*, from Flat Examples or Copies. Sections: *a*, Models and Objects; *b*, Ornament; *c*, Flowers and Foliage; *d*, Details of Human and Animal Figures; *e*, Landscape Details. Mediums used: 1, pencil; 2, chalk; 3, charcoal; 4, ink or sepia. *Stage V. Shading*, from the "Round" or Solid Forms. Sections: *a*, Geometrical Solids and Vases; *b*, Ornament from the cast; *c*, Flowers and Foliage from Nature; *d*, Details of Human and Animal Figures from the cast. Mediums used: 1, pencil, 2, chalk; 3, charcoal; 4, ink or sepia.
ELEMENTARY COURSE.	*Stage VI. Original Design.* Sections: *a*, Elementary Design of Geometric Forces to fill given spaces; *b*, Ornamental Arrangements of Natural Forms, conventionalized in one color or monochrome, to cover given
ADVANCED COURSE.	spaces; *c*, Ditto in color, harmonized; *d*, Applied Design for Surface Decorations; *e*, Applied Design for the "Round," in wood, stone, metal, or clay. Mediums used: 1, pencil; 2, chalk; 3, charcoal; 4, monochrome; 5, color.

WALTER SMITH,
Director of the Classes.

APPENDIX C.

INDUSTRIAL DRAWING IN NIGHT-CLASSES.

Before the student can apply a knowledge of drawing to industrial purposes, it is necessary that he should know how to draw, become practically acquainted with the process by which form is represented, and the different methods of representation.

Industrial drawing may be divided into two distinct classes: 1. Instrumental drawing. 2. Freehand drawing. The first being worked by means of compasses, squares, and other mechanical implements; the second wholly or partly by the freehand alone, without the aid of instruments.

1. *Instrumental Drawing.*

The distinct branches of this section, which will be generally required in industrial drawing, are:

a. Plane geometrical drawing,
b. Projection,
c. Perspective,

as elementary subjects; and

1. Building construction, and architectural drawing,
2. Machine drawing,

as advanced subjects.

Instruction in these subjects will be sought after by all who are engaged in the building trades, and by mechanics working in the machine and tool trades, also by architectural and engineering pupils working in offices.

2. *Freehand Drawing.*

This subject includes the representation of objects and ornament from both the flat and the round, the study of light and shade and color, and also of original design.

Students who are engaged in such occupations as lithography, fresco-painting, designing, architects' and engineers' offices, teaching drawing, carving, engraving, wood-cutting, decorating, drawing on wood, etc., will require instruction in this branch.

In each of these departments, some of the knowledge and practice found in the other will be of great advantage to the student. For this reason, there should be a *first year's course* common to both subjects, which all the students should be required to attend. This might be as follows:

FIRST YEAR'S COURSE IN ELEMENTARY FREEHAND AND INSTRUMENTAL DRAWING.

Subjects studied.

First Part.—1. Freehand outline drawing from copies and blackboard, with exercises in elementary design.
2. Plane geometrical drawing from copies and blackboard, with additional exercise problems given but not worked out by the teacher.

Second Part.—1. Model and object drawing, from copy and solid model.
2. Perspective drawing (for freehand students).
3. Projection (for instrumental students).

A course of elementary work such as this will be within the capacity of all the students, if suitable examples be provided. All the subjects can be taught by class-lectures, and therefore a large number of pupils, up to a maximum of fifty, can be taught by one teacher. The course will furnish the students with sufficient practice in both subjects to give an intelligent understanding of their elements, and prepare them for successful study of the second year's course. But the practice in the class-room alone is not sufficient. Every student should be required to work as much at home, between lessons, as he does with the teacher, in the class-room. The text-books used in the public schools on the various subjects, can be used also in the first year's course of the night classes.

SECOND YEAR'S COURSE.

1. *Instrumental Drawing.*

The study of the two subjects of machine drawing and building construction may be pursued in one class, comprising two sections, each section beginning with the elementary practical problems of the subject.

Thus, in *building construction*, the subjects should be the joints used in carpentry, door and window framing, construction of floors, partitions, roofs, and staircases, bond in brickwork, stonework, arches, fireproof flooring, designs of plans, elevations, sections, and perspective views of houses and other buildings, working drawings, details, etc.

In *machine drawing*, the details of machines, as bolts and nuts, plummer-blocks, screws of all threads, wheels toothed and beveled, eccentrics; machines, such as drills, lathes, pumps, steam-engines, locomotives, manufacturing machines, etc.

In both of these subjects the first and easy work will consist of simple projection *applied* to objects of industry, and these lessons may be given from the blackboard, the teacher drawing them step by step before the pupils, all working to scale, and the dimensions clearly marked in figures on the drawings.

But after the elementary forms have been drawn, then each student will be ready to follow his own specialty. Those engaged in building taking up either carpentry, masonry, or bricklaying, and those employed in machinery commencing a study of the particular class of machines they make in the workshop, or other details of their craftsmanship.

SECOND YEAR'S COURSE.

2. *Freehand Drawing.*

Drawing of ornament in outline from large copies of foliage and the human figure; shading of the same from copies in pencil, crayon, and Indian-ink, or sepia; designing in half-tint, or several tints of one color; drawing from memory and dictation, etc., would form the elementary part of the second year's course; while the more advanced section would comprise shading geometrical solids, shading from the casts and natural objects, applied design for industrial purposes, and special subjects suitable to the avocations of particular students.

The adoption of this method of grading the work into first and second year's study will be found satisfactory to both teacher and pupils—much of the want of progress and dissatisfaction sometimes existing in classes arising from advanced technical work being undertaken before any practical knowledge of the elements has been acquired, and does not usually arise either from want of ability on the part of pupils or of skill on the teacher's part.

For the first year's course, all the apparatus required will be the class-books generally used by the teacher, or those adopted in the public schools, together with a pair of compasses and ruler or paper square for each student, and some solid models to draw from.

For the second year's course, mounted copies of building construction and machine drawing of freehand outline, shading and coloring, and specimens of mechanical motions, examples of applied design, will be required, in order that the students may see the direct application of drawing to industrial pursuits.

In providing a room for study, the class room of the High School, if capable of seating adults, and properly lighted, is usually well adapted for the elementary or first year's course. For the second year's course, two rooms are required—one fitted up for freehand drawing from objects and specially lighted for that purpose, and a second for instrumental work.

ART EDUCATION.

By Professor C. O. THOMPSON, Worcester, Massachusetts.

DRAWING.

Art education embraces all those appliances and methods of training by which the sense of form and proportion is developed. It is successful when the student unerringly discriminates between what is ugly and what is beautiful, and expresses his ideas of form in drawing as readily as ideas of other sorts on the written page.

The interests of art education in Massachusetts center at present in the work undertaken and vigorously prosecuted by Mr. Walter Smith. This gentleman holds a commission from the City of Boston as General Supervisor of Drawing in the Public Schools, and one from the State of Massachusetts as State Director of Art Education. He was formerly a South Kensington art master at Leeds, England.

The plan of instruction for the schools is very simple. The teachers assemble at stated intervals, and the lesson is given them by Mr. Smith, which they are to reproduce in their schools. For the teachers of the State at large, this work is done at teachers' institutes.

The scheme of instruction for graded public schools is set forth in the following table:

Scheme of instruction in drawing suggested for graded public schools in Massachusetts, complying with the Act of eighteen hundred and seventy concerning industrial drawing. (Arranged by Walter Smith, State Director of Art Education, Massachusetts.)

Schools.	Classes.	Time given per week.	No. of lessons per week.	Length of lessons.	Drawing on—	Taught by—
		Hrs.		*Min.*		
1. Primary schools	6, 5, 4	2	4	30	Slates	Regular teachers.
2. Primary schools	*3, 2, 1	2	4	30	Paper in blank-books	Do.
3. Grammar schools	*6, 5, 4	2	3	40	Paper in blank-books and text-books	Do.
4. Grammar schools	*3, 2, 1	2	3	40	Paper in blank-books and text-books	Do.
5. Latin and high schools	*Lower classes	2	2	60	Paper in blank-books and text-books	Do.
6. Latin and high schools	*Higher classes	2	2	60	Paper in blank-books and on sheets	Special instructors
7. Normal schools	*All the classes	2	2	60	Paper in blank-books	Do.

Subjects taught, and order of lessons for each week.—The figures 1, 2, 3, 4, signify the first, second, third, and fourth lessons in each week.

Where two alternative subjects are named, one is to be taken one week and another the following week.

Reference to a text-book means that whatever drawing-book is in use in the schools shall be drawn from, as a distinct exercise.

All the classes marked thus * are to draw upon the blackboard, when the lesson is suitable to such an exercise; one third of the class to draw each lesson, so that the whole class will have drawn upon the board every three lessons.

1. Freehand outline from cards, charts, and blackboard lessons, the first copies. Memory lessons, drawing previous exercises from memory. Definition of plane geometry to be learned by heart, and illustrations drawn. Dictation lessons of right-line figures and simple curves.

Order of lessons: 1. From cards or charts. 2. From blackboard. 3. Memory and dictation, alternately. 4. Geometric definitions.

2. The more advanced copies in cards, charts, and blackboard lessons. Memory and dictation lessons (without illustrations). Object lessons, illustrated by drawings. Geometric definitions, drawn on a large scale.

Order of lessons: 1. From cards or charts. 2. From blackboard. 3. Memory and dictation, alternately. 4. Object lessons and geometric definitions, alternately.

3. Freehand outlines of ornament and objects from blackboard. Lessons in text-book. Map drawing. Memory and dictation lessons. Geometric exercises, plane geometry, up to fifty problems of constructional figures.

Order of lessons: 1. Objects from blackboard and drawing from text-book, alternately. 2. Memory drawing and dictation exercises, alternately. 3. Geometric and map drawing, alternately.

4. Freehand outline drawing, from solid models. Geometric drawing, up to the end of the course. Design in geometric forms, from blackboard. Memory drawing. Map drawing. Dictation lessons.

Order of lessons: 1. Model drawing, from object. 2. Geometric and memory drawing, alternately. 3. Map drawing and design, alternately.

5. Model and object drawing, with exercises in perspective, drawn by the free hand. Object lessons, illustrating historic art and architecture. Shading from models and copies. Harmony and mixture of colors. Design from natural foliage.

Order of lessons: 1. Model shading and object lessons, alternately. 2. Lessons in color and exercises in design, alternately.

6. Perspective by instruments. Shading in chalk and color, from models and natural objects, and foliage. Design in color and shadow. Projection. Lectures on painting, sculpture, and architecture.

Order of lessons: 1. Perspective and projection, alternately. 2. Painting or shading and design, alternately.

7. Object drawing and design. Ornamental design. Historic lessons. Advanced dictation and memory lessons. Lessons in teaching drawing. Perspective, advanced. Designing blackboard examples.

Order of lessons: 1. Object drawing and design, alternately. 2. Perspective and dictation or memory lessons, alternately. 3. Lessons in teaching drawing, occasionally.

The results so far obtained, though necessarily meager, are very encouraging. A large majority of teachers in the State will second the resolution recently adopted by a convention of London schoolmasters: "That half the time previously given to writing had been given to drawing, with the result that the writing had been better, and the power of drawing was a clear gain." This was in eighteen hundred and fifty-two, when England was beginning the series of experiments in art education which has culminated in South Kensington.

EVENING SCHOOLS FOR ADULTS.

The law requires all towns of more than ten thousand inhabitants to provide free instruction in drawing for mechanics and artisans and all others who may desire it. The law has been in force two years, and nearly all the towns included in its provisions have established evening drawing schools. An exhibition was held in Boston in May, eighteen hundred and seventy-two, when drawings from the different classes were exhibited, and great interest was thus awakened in the subject.

The report of the committee, C. C. Perkins, W. R. Ware, and Walter Smith, appointed to examine the drawings, affirms the entire success of the scheme, as judged by practical benefits, and suggests the necessity of large provision of models and art examples for future classes.

GENERAL IDEA.

The general grounds of public polity upon which these classes are deemed necessary and expedient have been thoroughly traversed. They belong in the same category as public libraries and reading rooms. The library is needed as a force to influence the faculties which the school has wakened and partially trained, and to guide them towards truth and justice. The drawing school is needed to carry forward the art training, begun in schools, to large and beneficent results in quickened invention and improved taste. If this art training has been neglected in school, the drawing class offers the community a chance to rectify the mistake. Drawing is regarded in this movement, not as an accomplishment for a few gifted individuals, but as a necessity in the future for every first-rate artisan.

WHO ATTEND THESE CLASSES.

Two sorts of pupils have appeared in them: First, those who are disposed to undertake a general art training, so as to learn to draw from models, free-hand, without reference to any immediate practical benefit. In this class are teachers, engravers, architects, stonecutters, and others. The main point in the training of such persons is discipline of the sense of form and proportion by carefully-studied exercises. The second class consists of artisans of all sorts, mainly machinists and carpenters, who have no time, or think they have none, for sheer art training, but want a knowledge of instrumental drawing which will be of immediate use in business. Statistics of the Worcester Class of eighteen hundred and seventy show some interesting results. The class numbered one hundred and forty-five—one hundred and thirty-six men and nine women. In respect of age, there were one over sixty, two between fifty and sixty, four between forty and fifty, twenty-eight between thirty and forty, sixty-one between twenty and thirty, and forty-nine under twenty. In respect of occupation, there were, of machinists, forty-two; carpenters, twenty-six; pattern makers, seven; architects, four; while the others represented thirty different trades and occupations.

More than half the class walked two miles to get the lessons; two thirds of them were usually in their seats a half hour before the lesson began; and three fourths of them were present at the last lesson as punctually as at the first.

In eighteen hundred and seventy-one there were two hundred and fifty, representing as great a variety of age and occupation as the first class. Other towns in the State have a similar record.

TESTIMONY TO THE NEED OF ART EDUCATION.

The statistics just given furnish strong evidence of the widely-felt need of these drawing classes. Other corroborative evidence is abundant. Mr. E. P. Morgan, mechanic engineer of the Saco Water-power Machine Shop, says: "Through the inability of our workmen to understand a working-drawing, hundreds of dollars are lost every year in this establishment." Commenting on this, Mr. Bartholomew, of Boston, says: "What is true in this case is true of our manufacturing establishments all over the land. The time lost in doing that which must be done again because of error, the loss of material and of power, the wear and tear of tools to no good purpose, the time of engineers and foremen spent in explaining drawings which would have been understood at a glance had the workmen been instructed in drawing, and the time consumed in listening to these explanations, cost the country, it is safe to say, millions of dollars annually."

Mr. C. H. Morgan, Superintendent of the Washburn & Moen Manufacturing Company, Worcester, Massachusetts, says: "When a boy, I was one of a class of thirteen who spent all their leisure time in studying drawing. At the present time every one of that class has attained to an important position, either as manufacturer or manager; and each has owed his power to seize the opportunity of his advancement to his knowledge of drawing."

Professor C. O. Thompson, of the Worcester Free Institute, says: "It is estimated that the productive efficiency of every machine shop would be increased thirty-three per cent if every journeyman could read any common working-drawing and work by it."

Professor Bail, of Yale College, says: "At the conclusion of a lesson in drawing, gray-haired mechanics have often almost overpowered me with thanks, saying, 'This lesson is worth hundreds of dollars to me;' or 'I shall work better all my life for this.'"

Abundant evidence of the same sort is contained in a pamphlet entitled "Papers on Drawing," issued by the Massachusetts Board of Education in eighteen hundred and seventy.

It is an important consideration that progress in ability to read a drawing is vastly more rapid than in skill to make one.

PLAN.

The plan pursued varies but little in the different towns. The whole number of lessons averages thirty each Winter. All beginners have ten lessons in freehand. There are three lessons in horizontal and vertical lines, and plain and ornamental forms composed of those lines; three lessons in curves; two lessons in perspective; two lessons in review of all these.

An important point here is, not to dwell on the mere practice of drawing straight lines. All drawing consists of lines, and these may as well be drawn in some relation one to another as isolated. After the preliminary ten lessons, there will be some persons in this class who will prefer to devote themselves to freehand work. Let such form a class and go on. They can begin at the sixteenth lesson, drawing from objects. Others will insist on instruction in "drawing to a scale," as it is called—*i. e.*, making plans, elevations, and projections. In the instruction of these persons, a good part of the time is spent in learning the elements of descriptive geometry—*i. e.*, the method of representation of any object in horizontal and vertical projections in any position. Each lesson occupies an hour and a half.

An important fact here is, that ordinary mechanics and artisans need not be reduced to the barren labor of copying either drawings or machines. It is possible to give them clear notions of the principles by which all solid objects are represented on a flat surface. This is, in fact, the only hopeful kind of instruction for them.

Copying, in any strict sense, should not be allowed in any of these classes. The pupils should see the teacher work at the blackboard. The *process* is the important thing for them, rather than the result. The difference between this method and working from copies is exactly an-

alogous to that between translating a page of Latin with or without the aid of a translation.

After the first Winter in any town there will arise a necessity for an advanced class in freehand drawing, the same in mechanic drawing, and in certain cases for instruction in special branches, as carpentering, ship construction, etc.

AUXILIARIES.

Teachers.—It is found that good draughtsmen do not necessarily make good teachers. Attendance at a technic school or a normal class, at least, is indispensable. A good teacher commands ten dollars an evening for his services.

Models.—Sets of models for the freehand classes and for schools are made, after designs by Walter Smith, at the workshop of the Worcester school. A collection of models for the mechanic classes can be obtained for the asking in any large manufacturing town. It will consist mainly of patterns and castings of parts of machines. Good models are indispensable.

Utensils.—The town furnishes a room, warmed and lighted, and equips it with tables and models. The pupil provides drawing-board, paper, instruments, etc.

Books.—For teachers, Mr. Walter Smith has published his address at Lewistown, before the American Institute of Instruction; The Teachers' Companion, designed to accompany the models; and Art Education, or Lowell Lectures of eighteen hundred and seventy-one. He is preparing a series of text-books on freehand, perspective, and model drawing. Teachers of mechanic drawing will get very valuable aid from a set of lessons given at the Ecole de Dessin in Paris, by MM. Petitcolui and Chaumont.

Art Museums.—The great need beyond all others, the great result which all this work, at present so interesting, is to accomplish, is the establishment of an art museum at every important manufacturing center. Such a museum is in progress at Boston. When it is completed, art education will begin in earnest.

STATE NORMAL ART SCHOOL.

This institution was established by legislative action in eighteen hundred and seventy-three, it having become evident that, if drawing was to be successfully taught in the public schools, provision must be made for the training of competent teachers.

Its specific aim is to prepare teachers for the industrial drawing schools of the State, who may also superintend instruction in drawing in the public schools. In the future it may be necessary to provide for high skill in technic drawing and fine art culture, but the immediate pressing demand is for teachers who know thoroughly the elementary subjects and can teach them with fair intelligence. This demand the school will aim to supply by providing, at the outset, training in elementary studies only, making this, however, as complete and practical as circumstances will admit.

Conditions of admission.—For the first year, connection with the public schools or with the industrial evening classes in the State will be a condition of admission. But if this class of applicants should not fill the school, the complement will be made up of the most promising can-

didates resident in the State who declare their intention to become teachers of drawing. If there is still room, others, residents or non-residents, may be admitted. In every instance, however, an examination in freehand drawing will precede admission, and only those who show an aptitude for drawing, with some proficiency in its elements, can be received.

Course of instruction.—The course for the first year only is determined. During this year there will be careful individual instruction in freehand drawing, painting, and designing. Instrumental industrial drawing will be taught by lectures, with blackboard illustrations, which method will also be pursued in the instruction in architecture, machine drawing, orthographic projection, isometric projection, projection of shades and shadows, geometric drawing, and perspective.

The school year.—The school year, which began November sixth, eighteen hundred and seventy-three, will terminate May ninth, eighteen hundred and seventy-four, the sessions for ordinary students being on Mondays, Tuesdays, Thursdays, and Fridays of each week, from nine A. M. to two P. M., and from three to five and seven to nine P. M. Students engaged in teaching drawing are required to attend four of these sessions per week; and those not so engaged, eight sessions per week. For teachers of the State normal schools, a special session is held on Wednesday of each week, from three to five P. M.

Examinations and diplomas.—To secure permission to be examined for a diploma, each student must submit twenty-four exercises, the subjects of which are indicated in a printed list of diploma works. These exercises are to show whether the student possesses the manipulative skill necessary to teach drawing. If they should be approved, the student will be allowed to offer himself for the diploma examination held at the close of the annual session. This being passed satisfactorily, a diploma will be given testifying to the scientific and artistic qualifications of the holder to give instruction in elementary drawing.

Should a student fail to pass on any subject, he may present himself again at a subsequent examination, the subjects already passed being recorded in his favor; but he cannot receive the diploma of the school until all the subjects given out for examination have been passed successfully.

Demand for such a school.—Four months after the opening of the school two hundred applications for admission had been received. The Superintendent, indeed, estimates that if all the needed conveniencies were given, such a school must open next year with five hundred pupils. He says that he has in his desk applications from many colleges and universities in several States for accomplished teachers of art, to which he is unable to make any favorable response, from lack of present trained *matériel*, and fears that such *matériel* cannot be prepared in less than four years with the instrumentality already in his hands.

He expresses a hope that America may yet have an institution kindred with the great industrial art schools of European States, which may, through its graduates, affect the value and beauty of every branch of industry.

SCHOOL LESSONS IN HOUSEHOLD ECONOMY.

By MRS. WILLIAM SHAEN.

[Reprinted, with additions, in "Good Words" for November, 1871.]

It is rather a perilous undertaking just now to propose a fresh subject of instruction for girls. A little while ago, every one was asking what new branches of knowledge could best be introduced into our new educational schemes; now the more pressing inquiry seems to be, what topics can be safely left out. Time-tables, though elastic, have their limits; and to squeeze a due amount of science, art, and general culture into the hours between breakfast and tea-time, while leaving sufficient space for play and physical training, is not an easy task. Before the ground is entirely occupied, however, I should like to bespeak a place for an unpretending subject, which seems likely to be kept out of sight by the crowd of more imposing studies. Housekeeping may be a commonplace matter, but it is the one art which every woman is certain to have to practice at some time in her life, and a knowledge of it ought surely, therefore, to be secured to her, as an essential part of her education. And if the startling calculation be correct, that English middle-class girls commonly devote about five thousand hours of their school life to the piano, as against six hundred given to arithmetic, one cannot help thinking that a small slice off the thousands might well be spared for teaching them how to take care of their future homes.

As to what housekeeping consists in, there seems, however, to be considerable difference of opinion. Gentlemen are apt to identify it with cooking, and in the outpourings of masculine discontent which from time to time effervesce in the newspapers, we usually see it taken for granted that "good cookery is the want of the age," bad dinners the bane of English life, and the best housewife she who has best studied Francatelli or Cre-fydd. Ladies do not often take so low and narrow a view of the matter; but even they are not quite agreed as to the scope of the occupation. Many look upon it as a small affair, to be disposed of in ten minutes of a day otherwise devoted to culture, philanthropy, or gossip; many more feel it to be a heavy business, tasking and absorbing all their powers. Some think that it should be learnt exclusively at home; others that it can be studied to better advantage at school. Still, we believe most of us are now convinced that the art, whatever it is, ought to be cultivated somewhat more systematically than has hitherto been done; and the present attempt to put the subject in a practical form will, I trust, be candidly received by partisans of all sections—from those on the Extreme Right, who hold housekeeping to be the Whole Duty of Woman, and the home trials of idle servants and extortionate tradespeople the most appropriate discipline for her mental and moral faculties, to those on the Extreme Left, who maintain that

her powers are co-extensive with the entire range of human endeavor, and that (like the well known elephant to whom trees and pins came equally handy) under her management politics and puddings alike are sure to turn out well.

By far the most formidable objection to teaching domestic economy in schools comes from those who condemn all technical training whatever, as tending to lower the tone of education and degrade its aims. This evil can hardly arise, however, unless the special aims are allowed to usurp the place of the higher and larger ones; and in point of fact, much that is technical is necessarily included in all education, however liberal. The pence-table is technical knowledge, absolutely necessary in England, utterly useless elsewhere; but we do not on that account decry it in favor of the multiplication table, which holds good for all humanity; we teach them both. And, in the same way, to give girls the special kinds of knowledge that fit them for their special duties as wives and mothers, need in no degree interfere with their general intellectual development, which has aims of its own. The admirable scheme of instruction adopted last Summer by the London School Board includes domestic economy in its carefully sifted list of discretionary subjects, although its whole plan is evidently designed to raise the standard of primary education above what is merely required for earning a livelihood.

If, however, girls are to be really taught how to take care of a house, and of the people who live in it, they should begin at the beginning of the subject; and in this way many things will come easy to them, which present a mere tangle of difficulties when taken up at the wrong end.

1. *House Fittings.*—In the first place, they ought to understand something of the internal construction of a house, and of what builders call its "fittings." The mechanism connected with water supply, gas, and bells could be easily explained to them, as well as the construction of a kitchen-range; and their notions of hydrostatics and pneumatics would be all the clearer for an actual inspection of ball-cocks and cisterns, ovens and dampers. Smoky chimneys may seem too transcendental a subject for a school-room; but without diving into its deeper mysteries, young people might be told the commonest causes and cures of this calamity, including the wise and unwise modes of lighting a fire and putting on coals. Nor would any special apparatus be required for instruction of this kind. Visible defects and their practical consequences strike the imagination much more forcibly than successful experiments performed upon a lecture-table; and to illustrate these lessons, a kitchen-range or ventilator that did not work well, would be far preferable to a faultless one. Any ordinary house with its ordinary grievances of gas-escapes and leaking pipes, bells that will not ring, shutters that will not shut, and windows that will not open, would furnish abundant examples; and if ordinary housekeepers had more knowledge on these matters, they would no longer be at the mercy of every workman coming in "to do a job," or of every cook declaring that "the oven wouldn't draw." Speculative builders might find it a less profitable investment to run up cheap and showy "residences" with unsound roofs and shaky floors, if young couples, when looking out for an earthly paradise, were on their guard against the wiles of the tempter; and paradise might prove a less

expensive luxury if every Eve had the good sense to prefer a dry and well built cottage to a damp and tottering villa.

2. *Furniture.*—It may seem pedantic to insist that school girls should not only be taught what houses are made of, but also how furniture is put together; yet surely the construction of our tables and chairs is as important to us as that of multivalve and bivalve shells, and decidedly easier to remember. The difference between good carpentering with its mortising and dovetailing, and the bad joinery in which nails and glue form the chief means of adhesion, may be seen by merely comparing the workmanship of a well-made and an ill-made work-box; and half an hour's lesson over pots and pans, brooms and kitchen utensils, would give a girl an amount of insight into common things which it often takes years of costly experience for her to acquire in after life. We can imagine the consternation in some of our huge furnishing establishments, if the young brides who now give their orders with such sweet unconsciousness, were beheld turning up chairs and pulling out drawers to examine the merits of the joinery, or peering into saucepans and coal-scuttles to see how they would stand wear and tear. And perhaps the alarm might be equally great in the kitchen if it were discovered that "mistress" knew exactly how long things ought to last, as well as how they ought to be kept meanwhile, and objected to the rapid destruction which now goes on often less from willful carelessness than from simple want of intelligence alike in servants and in those who direct them.

3. *Cleaning.*—We now come to one of the most important branches of household management, yet one which scarcely any lady ever attempts to acquaint herself with in a systematic manner. To keep thoroughly clean all the various materials composing a house-interior and its furniture is evidently a complicated art, requiring considerable knowledge, zeal, and skill; and yet we are content to leave it all to uneducated maids who have never heard of Miss Nightingale's "Notes on Nursing," have no horror of organic matter, and are quite content if they wipe the dust off mantelpieces and what-nots, while leaving it in thick layers upon the tops of wardrobes, bedsteads, picture-frames, and all surfaces out of sight. We send our things to a laundress once a week, and consider them fit to wear when they come home again, though probably in the interval they have merely been passed through a little colored water, and dried and ironed in a close room. It is true that we shudder as we read "Dust and Disease," and almost wonder to find ourselves still alive after having breathed for so many years the noxious compound of detritus and gases called air; but as we close the book we relapse into a vague hope that the world, after all, may not be quite so bad a place as Professor Tyndall paints it, and after a few faint efforts at improvement, we allow our rooms to resume their accustomed grittiness. Whether it is possible ever to keep a town house really clean, is, I admit, an open question; but until refined and intelligent women give their minds to it, we cannot even tell how much may be done, and how much must be despaired of.

And the difficulty is an increasing one. If we compare our lot with that of our grandmothers in their sparely-furnished parlors and simpler mode of life, we see that their task was a much easier one than ours is. We crowd our drawing rooms with ottomans, curtains, and knick-knacks, and our nurseries with toys, while our dress grows more multifarious and cumbersome every day; in fact, in our English love of comfort, we go on surrounding ourselves with ever fresh conveniences, until we hardly know which way to turn. Now all these conveniences have one quality in common, that they "collect the dirt," as servants say, and thus they make fresh trouble for us on the one hand, while designed to save it on the other. I do not urge that the young ladies of a household should actually dust the china or brush the curtains, though they might do worse things; but they certainly ought to know the right way of cleansing everything in a house, from floors and walls to crockery and stew-pans; should watch the processes and examine the results. Many mistresses cannot recognize defective cleaning even when it is before their eyes, and are quite satisfied if they see a pail of water carried about, though the boards may have been only smeared instead of scrubbed. For ignorance of this kind, at least, the remedy is not far to seek; and when ladies know better how to superintend, probably they will find servants more willing to execute.

4. *Food.*—Comparatively well trodden ground here lies before us. All allow that women ought to know more or less of cookery, and in some schools, the physiology of nutrition, with its relation to the chief articles of food in common use, is now, most wisely, included among the subjects of instruction. This forms an excellent foundation, and there is surely no reason why the pupils should not next be taught how to judge of the good and bad qualities of these articles themselves, which is, in fact, the art of marketing. Samples of most of them, such as milk, bread, butter, and groceries of all sorts, should be shown and examined, accompanied by specimens of the commoner adulterated forms of these. Teaching of this kind might be made to fit in with the scientific object lessons so strongly recommended by Professor Huxley; and the girls would care none the less for their chemistry when they found that marmalade and bonbons came within its range. Fraudulent tradesmen, too, might have misgivings if they discovered that in every girls' school in the parish, samples of their deceptive wares were being passed from hand to hand, and sharply scrutinized by bright and knowing eyes.

Here, however, a serious difficulty comes across our path. Meat and game, fish and vegetables, could not well be exhibited at an object lesson; yet if our dinner-tables are to reap the benefit of our teaching, these important items must not be omitted. We all know the uncivil comparisons that some gentlemen are apt to draw between club dinners and home ones, and how it hurts a wife's feelings to be told on making a rueful apology for waxy potatoes: "Well, I know nothing of *your* greengrocer except his bills; but I always get capital potatoes at the club." Perhaps the wife sighs, and wishes she knew where the club steward bought his supplies; but is met by the cutting remark: "Well, you ought to know as much about shopping as he does, I'm sure." Now, alas! this is perfectly true; but the question is, How is she to do it? Without attempting an answer, I will only ask, Why should not girls learn all these matters of detail during the years when they have no cares to hamper them? Is it too utopian to suggest that a competent teacher might take her class to a market just as simply as they are now often taken to a museum, and in this way might give them all necessary information upon the spot?

The art of keeping food in a wholesome and palatable condition is quite as important as that of marketing, and as seldom taught. Young housewives pick up a little knowledge of it for themselves when they come to have a larder and a store-room of their own; but it could be learnt much more systematically at school, where it might be linked on

to lessons in chemistry. The well-worn topic of cookery may be passed over with only one remark, namely: that while practice should not be neglected, it is still more essential that the principles of all culinary processes should be thoroughly understood. Those of leavening, baking, roasting, and the other usual modes of preparing food, ought to be so mastered, that a girl, when an ill-dressed dish appears upon the table, should not only be able to point out its defects, but also to tell (or, at least, to guess,) whence they have arisen. It is of much more consequence, for instance, that she should know the three commonest causes for suet pudding turning out heavy, than that she should have made a dozen apple dumplings herself in as bewitching a white apron as ever Ruth Pinch wore, especially as two of these causes do not come into operation until after she has left the kitchen. Many young women who are wise about soups for the poor and beef tea for invalids, have been taught nothing about the management of a kitchen fire, a matter on which the success and punctuality of all meals so much depend, and are entirely at the mercy of their cook's excuses for every scorched joint and burnt or tepid sauce. Besides, it is not until a housewife has mastered the rudiments of the subject that she has leisure to review her resources and to display a little variety in her every-day *menus*; and we all know how it helps to raise the family spirits and smooth the family temper when dinner is a time for pleasant surprises instead of depressing monotony. It would be superfluous to go into the details of a subject on which practical experience so abounds, and good books are so plentiful; but a teacher should take care that her pupils appreciate its full extent and respect it accordingly, and do not imagine good cookery to be a mere affair of clever recipes for cheap or dainty dishes.

Nor must actual practice be undervalued, though it has hitherto often been cultivated to the neglect of theory in this branch of household education; and the whole result has, therefore, been unintelligent and incomplete. To the poor the importance of experimental knowledge of culinary matters is so great, that undoubtedly practical teaching in cookery ought to be given in all primary schools, where the expense it involves does not form an insuperable difficulty; and any available spare funds could hardly be more usefully employed than in providing the appliances and materials required for such instruction. For girls in the middle class, training of this kind is very desirable, and to intending emigrants (an increasing section of the community) it is indispensable.

5. *Clothing.*—Girls' love of dress is a stock subject for reprehension, but instead of declaiming against it, might we not endeavor to turn it to account? In order to improve their morals and repress their vanity, we tell them that dress is a frivolous concern, unworthy of much serious attention; let us rather teach them that it is one involving some duty, some trouble, and a good deal of pleasure. They are quite right in taking pains to "look nice," and when they are grown up, and have families of their own, their children ought to look nice too; but wholesomeness, comfort, and economy will have to be thought of as well as beauty, and if our young housewives are to know how to secure all these, some little preparation is needed to fit them for their task. Mere passive obedience to dressmakers and milliners is by no means a sufficient qualification. The amount of preparation needed would, of course, depend to some extent on the social position of the pupils; but all should understand the general principles of cutting out, and should know something of the different materials employed. They might be shown, for

instance, the respective advantages of linen and cotton fabrics, and why it is that the dearer kinds, with their round even thread, and loose open texture, wear better and wash cleaner than the cheaper qualities, with their flattened fiber and close pasty make, though the latter "look finer for the money." Shopping does not come to us by nature, whatever our enemies may say; it is an accomplishment we have to learn. Good taste is, perhaps, a thing that it is impossible to teach; but if girls were led to see the relation of clothing to health and gracefulness, such fashions as tight lacing, high heels, and the Grecian bend would be looked upon with repugnance, as well as disapproval.

Plain sewing is an art which every woman can and ought to carry to perfection, and as it is the only one in the whole range of education, masculine or feminine, in which this high ideal is attainable, let us make the most of our distinction. Of late years it has been somewhat neglected, but no girl ought to leave school without having thoroughly mastered it, from the rudimentary hemming up to the higher branches of Mending, Patching, and Darning. These require not only manual dexterity, but also inventiveness, power of adaptation, and common sense to judge what is worth doing, and what is labor thrown away, and are thus an exercise of intellect no less than of skill. The use of a sewing machine should also be taught, and the principles of its construction sufficiently explained to enable the pupils to use it intelligently, and with less risk of putting it out of order. These machines seem hitherto to have been employed rather to multiply the number of stitches put into garments than to economise the time spent in needlework. This is to be regretted, for the occupation is, after all, but a means to an end, not an end in itself. Dress was both prettier and more convenient fifteen years ago than it is now, though made so much more simply then; and if the total quantity of work put into it could be reduced to what it was at that time, the use of machines would now set free a considerable amount of time and labor which might be employed advantageously in other directions. The difficulty of turning the spare productive power of women earning their livelihood by sewing into other and better channels, is one which does not concern us here; but in home life it should be kept steadily in view, that the chief use of machines is to diminish the whole amount of time and trouble devoted to needlework, and thus to leave a greater portion free for more important purposes.

6. *Health.*—There is a certain amount of knowledge on this subject which ought to be as universal a part of education as writing is; yet it is quite as important to stop short at the right point, and not to direct the attention of the young too much to their own minute physical sensations. Some of the chief physiological laws of life may be explained to them, and a good deal of practical information can be given as to the ways in which our physical well being is affected by the arrangements of our daily life. They should be taught, for instance, the importance of ventilation, of good water supply, and of admitting plenty of actual sunshine as well as light into our rooms. Many of the sanitary reasons for maintaining efficient household cleanliness, and for airing bedding and wearing apparel, can also be made clear to them; and they should be told the first and simplest precautions to be resorted to in case of ordinary accidents. Perhaps there is no great danger, as yet, of teaching of this kind being carried too far; still it is a risk that should not be lost sight of, since it would tend to interfere with that wholesome unconsciousness which is one of the most important elements in the life of children. We have heard of an old physician who,

on being asked one hot day whether he did not want the window opened, replied somewhat testily: "Bless me, no! I'm not one of your miserable modern molly-coddles that can't sit still in a room five minutes without beginning to fidget about ventilation." Although far from sharing his prejudices, we may admit that there is a possibility of making young people too fussy about matters of health, though no doubt the opposite evil of carelessness and ignorance on such subjects is a far more common and a more mischievous one.

7. *Money.*—Domestic account-keeping requires no knowledge of arithmetic beyond what is ordinarily gained at school, but the pupils should be taught how to keep a ledger, balance a cash-book, check tradesmen's accounts, and also how to calculate averages, in order to estimate rates of expenditure. Probably it would be unwise to attempt more than this in the higher grades of schools, but in the primary ones it would be an excellent thing for the girls to receive complete instruction in the management of money, if their parents' jealousy did not stand in the way. All who have seen much of the poor know the waste that often goes on even in respectable families from their custom of letting money slip through their fingers without planning beforehand how it can best be laid out. District visitors can do little to rectify a rooted habit of this kind, even where they have any right to offer advice; but the elder girls in a school could easily be taught how, for instance, to make the most out of a given sum of wages, and at what rate a household ought to lay by in Summer to provide for the Winter expenses. In the middle classes, young women have plenty of opportunity for studying economical matters at home, but it is to be wished that they used their opportunities better than they usually do. They will all, sooner or later, have the partial or entire management of an income, and they need a more adequate preparation for this than is derived from the spending of pin-money. They ought to have some conception, for instance, of the usual proportion between the different items of domestic expenditure; inexperienced mistresses, for want of this, often worry themselves causelessly about minute savings, while overlooking large sources of waste, any one of which, if stopped, would supply enough to cover the small expenses fretted at, and to set the whole household at ease. Young people should also have some idea of how far an income will go, and should be aware that its value depends not only upon its nominal amount, but upon its certainty or uncertainty, the place and ways in which it has to be spent, and several other circumstances. Were knowledge of this kind more general among women, it would often enable them to produce a greater amount of comfort in daily life out of the same amount of expenditure, and the practice of providing for the future might probably be carried out more universally and systematically than it now is, and much needless anxiety would thus be saved. It is uncertainty on these matters, not thoughtfulness, which causes the fussy frugality and unnecessary prudence that are sometimes mistaken for true economy. Thrift means thriving, not pinching; "waste nothing, grudge nothing," is the golden maxim of a housewife.

The course of instruction sketched in the preceding pages may, perhaps, be thought too meager, especially on the ornamental side; but if it is so, the materials for its expansion are abundant and obvious; in educating, as in ciphering, Addition is the easy rule to practice, Subtraction the more difficult one, and Proportion the hardest of all. My great fear has been of proposing to attempt too much, as this would not only encroach on the claims of higher studies, but might also provoke opposition from those parents who are already disposed to regard the whole subject as a superfluous one. Many will be ready to say to us: "Surely, you do not think it necessary for girls of refined intellect to acquire all the knowledge wanted by cooks, grocers, builders, and linen-drapers!" We reply: "Certainly not; it is unnecessary for the Queen to know how to steer a ship, manufacture a cartridge, or write a Chinese dispatch, but she must be able to insure that all needful details are rightly executed by those whose business it is to do so; and every woman should know how to insure this in her own sphere, whether small or large.

No doubt there is a danger of being too much absorbed by details, and perhaps M. Taine may be right in finding fault with English people for being over-practical. When he says that we do too little "to embellish life," and, while giving us credit for energy and persistence, accuses us of having our minds stuffed so full of facts that no room is left for ideas, we feel that there is some truth in his description. Still, we must not forget that our national characteristics mark out our strong points, and that we cannot afford to throw them away. If we are to emerge from our Philistinism into sweetness and light, it must be by mastering the practical, not by despising it. Whatever else a woman may know or not know, she has no right to be ignorant of the essentials of good housekeeping; but these once secured, then let her add on all that is beautiful as fast as her powers will admit—flowers, and pictures, and music, sweet sights, and scents, and sounds. Indeed, she can hardly possess a talent, from gardening up to play-writing, that may not in some way help to embellish home-life and brighten home-pleasures; and if she will enlarge the circle of her æsthetic sympathies, and admit house-decoration within the domain of ladies' fancy work, she may soon find enough to do. Why should she not paint the birds and flowers she knows best on the panels of a door or the border of a paper, and carve her own brackets and fern stands? Her work, however imperfect, would at least be more amusing to look at than the machine-made patterns and mock mediæval furniture of which we are so tired, and even its very defects would enable her to appreciate the good work of real artists with a quite new delight.

Some very judicious persons object altogether to giving the systematic instruction here recommended to girls while at school, on the ground that it would have a tendency to make them self-important at home, and imagine that they knew more about housekeeping than their mothers did. This would be a serious evil if it arose, but much might be done to prevent its occurrence. And the danger is, perhaps, not so great as it might appear at first sight; for young people are much less apt to be conceited about what they do as a part of their regular school work, and are scolded or praised for accordingly, than about what they attempt on the voluntary principle, and in the exercise of their own private judgment. When a girl writes a verse-translation for a literature lesson, and does it pretty well, she is far less disposed to be vain of her performance than when she composes a poem, "intended for no human eye," up in her own room at night, and does it very badly. Thus we may hope that pupils who had worked steadily through the course here suggested would be less anxious to show off their accomplishments than some young and untaught housekeepers are, when they first try their wings among jellies and account-books. Besides, as soon as a girl attempts to do real work at home, she at once finds the difference between theory and practice, and discovers that it is one thing to learn domestic econ-

omy at school, and another thing actually to *produce* good dinners, and clean, pretty, wholesome rooms, out of a given sum of money and a given set of circumstances, tempers, and capacities. At present, when a mother wishes to interest her daughter in house affairs, instead of intrusting her with definite duties, she generally begins by holding endless consultations with her over entrées and puddings, unpaid bills and servants' delinquencies—subjects exciting enough to the matronly mind, but decidedly dull to young people. Materfamilias proses and her daughter grows impatient, and at last breaks up the conference by exclaiming: "I would sooner write twenty letters for you, mamma, than discuss all cook's quarrels with the butcher." Deference is certainly not promoted by things as they are, and so we might as well try a change. If a girl came from school prepared at once to undertake the charge of some small department of home business, she would make plenty of mistakes, no doubt, and have to be set right; but she would at least feel that she was rendering real service, and handling real facts, and her respect for her mother would be heightened, not diminished, by her knowing something of the sort of work that mothers have to accomplish.

So far, indeed, from stimulating self-conceit, occupation of this kind would do much to develop common sense—a quality not always encouraged by the ordinary routine of school-work, and indeed injured by it, if the physical powers are overtasked. Lessons on matters of practical life would afford a relief to the strain of continued head work, while they would also call out exactly that sense of order and fitness, and that power of adapting means to ends, which are needed to regulate a great variety of intellectual pursuits going on at the same time. Women in their home-life have to keep in constant exercise the power of instantly recognizing the relative *importance* of different objects and occupations, all claiming their attention at once, and all in themselves right and desirable. Men appear to need less of it in their business pursuits, from the greater regularity and sameness of their work. It is a faculty as frequently deficient in gifted minds as in ordinary ones, and is of slow growth in all; though not identical with the moral instinct, it is closely akin to it, and both are developed by a study which, like the one I am advocating, gives insight into the wants of others, cultivates the habit of discrimination, and strengthens the sense of responsibility.

Another advantage to be hoped for as a result of teaching of this kind would be that it might improve the relations between mistresses and servants, at present in a somewhat chaotic condition. So far as this is owing to the deficiencies of the latter class, a gradual amelioration may be looked for from the influence of a good general education in the primary schools; and the thorough technical instruction here proposed would certainly help to promote this on the moral side no less than on the practical, because it would tend to give servants a respect for their own vocation, and to make them feel that their dignity consisted in understanding their business, and doing it well, not in despising it. But much of the evil must be traced to the incompetence of mistresses, which leaves them helpless in the hands of those whom they ought to rule. In the present state of things, many a woman, when she first marries, can scarcely be said to have fair play, for she has to pick up from her own domestics and her tradespeople the knowledge which she ought to bring with her as a part of her dowry when she first enters her new home. She gives contradictory orders, finds fault in the wrong place, and is irritated by her own inefficiency; her servants grow impertinent and exacting; and at last she is glad to leave the management of affairs to them, and to take refuge in less unpleasant occupations. We do not, indeed, wish our daughters to grow up models of unmitigated good sense, or to take pattern by those all-accomplished "managers," whose eyes seem to be everywhere at once, whose infallibility it is always inopportune to question, and whose husbands live under a despotism softened only by curtain-lectures. Such clever people are very provoking, and a lady has no need to concern herself with all the details of her servants' work; still, she ought surely to aim at possessing what is considered essential in all other heads of departments, namely: knowledge enough to test the information she receives from her subordinates, to guide their action, and combine their resources, and judgment enough to determine for herself the ends to be sought, and the means to be chosen for attaining them. Those working under her instinctively gauge her power of doing all these things, estimate her accordingly, and proportion their obedience to their estimation; she, on her side, is probably sufficiently alive to the necessity for enforcing authority, but she must also remember that authority to be enforced must be respected, and must deserve respect. I do not mean for a moment to imply that what is called "the servant difficulty" is due to the defects of mistresses alone, and would suddenly cease if mistresses were made perfect. On the contrary, it is but one feature of the general state of social transition through which we are now passing. The growth of intelligence is not wholly a peaceful process; the increased mental stir among all classes brings with it a rapid upspringing of new wishes, some good and some bad, and new claims, some just and some unjust. Clear-sighted sympathy is needed to distinguish between the two, and it is for the educated to use their eyes and consciences for the benefit of the less fortunate and less enlightened. There cannot but be a stream of difficulties between mistresses and servants for some time to come, and it needs good will on both sides to bridge it over, but certainly the mistress ought to go more than half way.

The management of servants, however, is not the only one of her tasks that would be lightened by an adequate previous preparation; the whole work of household economy would be simplified for her, and would consume less time. If she understood exactly how things ought to look in her kitchen, her drawing-room, and her nursery, a single glance there would tell her more than a long and prying examination reveals to inexperienced eyes. If she knew her subject well beforehand, she would get through more business in ten minutes' conversation with her cook or her nurse, than she can in half an hour if she has to draw the main part of her ideas from them before she can arrive at any conclusion; and in the same way, shopping, accounts, and domestic letter-writing might often be compressed into far less space than they now occupy. Anxiety would also be saved as well as time. In many cases it is not the toil of housekeeping that uses up a woman's energies, but its worry, and this is caused, in great measure, by the uncertainty arising from ignorance. When she is doubting whether her servants tell her the truth, whether her tradespeople cheat her, whether the water supply is wholesome, whether the pale faces of her children might not be transformed into rosy ones, if she did but know the right thing to do, these thoughts do not vanish the instant her actual work is

over, nor do they leave her the freedom of mind and brightness of spirit necessary to enable her to use her leisure worthily and happily. It is true that the opposite alternative is open to her—she may quench her doubts and enjoy her leisure; but if she adopts it, her family suffer in consequence, though from the nature of the case no one can ever gauge the extent to which they do so. We shall probably be told that there is no need for either alternative, and Philistine parents will meet us with the old objection to every change, that "on the whole, things turn out very well as they are." There is some truth in this; we have much to be proud of in our English homes, and by all means let us rightly prize the prudence, comfort, and order that already exist there. But if it is possible for us to increase these, to spend our money more wisely, to make our servants more efficient, our houses wholesomer and pleasanter, our children healthier, and our own and our husbands' lives easier and freer for all high pursuits, why should we not learn to do so? I do not wish to claim too much for Domestic Economy, or to stretch the term so as to make it include the full moral life of home; but we may surely say that when rightly carried out, it forms a sound foundation for this to rest upon. Women who are without the capacity to discharge their lesser duties properly are in a disadvantageous position for undertaking their greater ones. But in a household where each one feels that she is in her right place, and is doing her right work well, that what she does is appreciated, and effectually helps to secure the comfort and welfare of those around her; in such a household many of the minor frets and worries of life are swept away, and a bright and peaceful atmosphere prevails, in which the nobler virtues can more easily flourish, and grow healthy and strong. With these comes the perception of the wide field of duty lying outside the circle of domestic well-being, but of which that circle forms the quiet and steady center; and it is when we can take the clearest view of the whole range of our obligations that we most deeply feel that the higher, richer, and more beautiful our home-life becomes, the more worthily and wisely may we hope to do the work that lies beyond it.

We often see it assumed that there is some sort of natural antagonism between the two spheres of action, but this surely implies a misconception of the nature of each. The very same training of our faculties that fits us for the one fits us for the other, while the absence of such training is equally fatal to both. If a woman does not possess the knowledge, energy, patience, and sympathy requisite to enable her to manage rightly the concerns of her own family, she will do little good, and probably a good deal of harm, in her attempts to advise and help the poor, or to aid in the oversight of workhouses and hospitals; but if she does possess those qualities, then it is impossible for her interest in her fellow creatures to stop short of the threshold of her own home. Nor is it possible in the present day for her to engage in philanthropic work, and yet to ignore the social and political questions that bear upon it. She may be unable to see her way through the difficulties that beset such subjects as pauperism and education, but at any rate she cannot avoid thinking about them. However lamentable may be the separation of classes amongst us, it is at least a hopeful sign that no one class now finds it possible to rest satisfied with things as they are, while other classes are suffering from terrible evils that admit of remedy. What the right remedies are, is, of course, a question that opens up many of the most complicated problems of the day; all that we have to do with them here is to note that they are problems which women have to face, which

they ought to take some pains to understand, and towards the solution of which the wisdom and practical experience gained in home-life afford valuable aid. Among the poor we can frequently see the way in which ignorance of common things not only cuts them off from many attainable comforts, and increases their physical misery, but also misleads them as to the right means of bettering their condition. It makes them apt to snatch eagerly at every idea of legislative relief, forgetting that if they want to draw the difficult line between what the State is bound to attempt and what it ought to let alone, it is quite as important for them to find out how much they can do for themselves, as to show how much lies beyond their power. For instance, they would not wish that the State should undertake to sell them retail goods at wholesale prices, if they knew how far their own prudence and intelligence might go in improving their marketing, and how much better it is for them to exercise forethought of their own than to pay government officials to exercise it for them. On the other hand, if they understood matters of health as every grown man and woman ought to understand them, they would press even more earnestly than they now do for those sanitary improvements which the State alone can effect. We may not be prepared to accept the Seven Propositions, but as we read "Episodes in an Obscure Life," or, entering London by one of the southern railways, look down on the dreary miles of squalid streets and crowded dwellings into which pure air can never come, the image of "homesteads out in the clear," with happy hearty children, brought up to enjoy wholesome labor and honest pleasures, is one to which we turn with a sense of relief. How the conditions of family well-being are to be brought within the reach of the whole people, is a problem which may well task the energies of statesmen and philanthropists for many years to come; still, any step, however insignificant, which may help us to a better understanding of it, is worth our consideration. The step which I have tried to indicate in these pages is a very small one, but at least it would rest upon a solid ground of fact, and it is one that could be taken without much delay. If all girls were taught how to turn to the best account the materials of comfort and enjoyment existing in their own homes, it would do much to check the English habit of wastefulness with which all foreigners reproach us; it would open to the rich fresh sources of simple pleasure more satisfying than the restless luxury which threatens to flood our civilization; it would bring to the poor new springs of hope and self respect; and for all it would help to multiply and brighten

"the home delights
That penetrate and purify the world."

* "Armgart," by George Eliot.

INDUSTRIAL TRAINING FOR GIRLS,

WITH PRACTICAL LESSONS IN HOUSEHOLD ECONOMY, AS TAUGHT IN GERMANY.

[By J. FRED. MYERS, Washington, D. C.]

A Russian publicist of intelligence and high standing, who had devoted many years of his life to projects of reform in his native land (all of which had been unsuccessful), finally discovered that the real mission of a philanthropist in that Empire lay in the introduction of a more liberal and thorough system of education among the masses, and his chief regret seemed to be that he had made this discovery too late in life to take full advantage of the knowledge so dearly purchased.

Not Russia alone, but all European nations, are agitating this vital question, because neither civil nor political institutions can progress faster than the educational system of a nation will bear. It is, therefore, unquestionably one of the most assuring symptoms of the prosperity of mankind in the future, that there are in the present era so many distinguished and philosophic minds engaged in the field of educational inquiry. Educational literature, already large, is annually increasing by the acquisition of books, pamphlets, and periodicals. In addition to this, the local press of the United States very generally gives a column each week to the discussion and advancement of educational interests. Yet, notwithstanding these increasing activities, the full importance of the subject is rarely comprehended, for the safety of the Republic and the foundation of order, as well as the solution of the intricate problems of social science and of political and domestic economy, are dependent thereon. Education is conceded to be, by even the bitterest opponents to its introduction among the masses, the supporting pillar of all political and religious institutions. Though much has been written, educational science is still in its infancy, and the discussion of its methods has not exhausted the theme. In fact, the science of education is so extended in its scope, that, as an astronomer can only observe an infinitesimal part of the horizon at one time, so a thorough view of the educational field can only be obtained by separate discussions of its various phases; and it is only a portion of one of these we are about to bring under examination.

In a recent tour through Europe, our attention was particularly directed to the question whether a special training for female pupils in our public schools would be of advantage. We waive that branch of the inquiry which would discuss the propriety or the desirability of educating both sexes (subsequently to the age of fourteen years) in separate apartments. Whether the sexes are trained in separate apartments or together, it is evident the general course of life and future destiny of the average man and woman are radically different. Exceptions there are; for women are sometimes found filling creditably the places of men.

Some have already graduated from universities, with honor, as doctors of medicine, as ministers of the gospel, and as lawyers and professors. The masses of women, however, cannot, any more than the masses of men, become members of the learned professions, but will have to engage in manual labor and business pursuits. To all who choose to become, and are capable of becoming, graduates of universities, the doors of such institutions should be open; and the question on entering and graduating should not be, What is the sex of the scholar? but, What are the mental attainments?

SPECIAL TRAINING AS TEACHERS.

One of the curious blunders which so many writers make when comparing the sexes, is that they compare the best woman with the average man, instead of comparing the best with the best or the average with the average. The destiny of the average woman is to become, in the capacity of wife, mother, or daughter, the superintendent of the household; nor does it matter, in principle, whether this involves the doing of household work with her own hands or through the agency of servants. Upon the average woman also devolve the education and training of children, the households where the father takes the charge of the education of the children being exceedingly rare. Thus, if education means the development of the mental and moral powers of the individual to their utmost usefulness in life, girls ought to be so taught as to enable them to manage the children of the household successfully and secure both the affection and obedience of the little ones intrusted to their care. If this is correct, it follows that in all our higher educational institutions, such as, for instance, our union or high schools, and in our academies, special instruction should be given upon these topics, and the advanced female pupils should be detailed as teachers to the primary schools, under the guardianship of the regular teachers, so that they may have some experience in the practical management of children.

In Germany, the Kindergarten schools are considered invaluable aids for this purpose; so much so that princesses and ladies of the highest nobility engage in them as amateur teachers, for the chief purpose of learning how to obtain control over their own children; for these ladies realize, more fully than those who are born in the ordinary walks of life, what a delicate and responsible a task it is to so fortify children in character that they may be able to resist the innumerable temptations which high station and riches always bring. Instruction in the art of teaching and controlling children will, therefore, be of great advantage, not merely to women who expect to become professional teachers (and a very large number in the United States teach for a greater or less period), but to all, in enabling them to become successful instructors and controllers of their own children, in case the future should bring with it these blessings.

FEMALE HANDIWORK.

The average woman is placed in a position where a thorough knowledge of needlework will be a source of comfort when presiding over a family.

In the common schools of Germany two afternoons in each week are set apart for the instruction of girls, by a competent person, in the art of sewing, the pupils beginning, as early as six years of age, with sew-

ing through paper. They are also taught to knit, each child furnishing its own material and keeping the product of its labor. When they have learned to hem, the next step is mending. Neat mending will be found to require much greater care and skill than is generally supposed, and much wearing apparel is thrown aside because the owner does not possess the necessary knowledge to mend it in a skillful manner. From plain sewing, mending, and knitting, the pupil advances to fine needlework, tatting, and crocheting. Some of the tapestry-work of the older pupils is often so beautiful in design and so artistic in execution as to challenge general admiration. We saw some of this work at the Vienna Exposition, in the female handiwork department, which fell short only of the master works of the Middle Ages in flexibility and expression.

The average woman becomes the wife of the mechanic and the workingman, and a complete knowledge of sewing is to her a great source of comfort as well as of profit, and enables the family to save a sufficient amount to secure a home and protection against poverty when age, with its incidental weaknesses, draws nigh. Therefore, as our common schools are intended more especially for the average children of our country, the teaching of the art of needlework, which might also be extended to learning the use of the sewing machine, ought not to be neglected. At present our girls are either compelled to pick up a knowledge of this useful art by piecemeal or become apprentices to some dressmaker or milliner, which, for various reasons, is rarely practicable. Instruction in needlework in the school would encourage economy and industry, and become a solid benefit to many households. The higher branches of artistic needlework would, as they have in centuries gone by, afford pleasant occupation to the wealthy classes, who are suffering from *ennui*.

Since nearly all the teachers of female pupils in our common schools are ladies, it seems to us that it would increase the interest of both teachers and pupils if two half days were set apart for instruction in sewing, mending, and knitting. It certainly would be popular with parents, who would quickly perceive the advantage which the product of the labor and the increased diligence and skill of the children would bring to the household.

DOMESTIC ECONOMY TAUGHT AS A SCIENCE.

Another most important and useful branch of instruction is the delivery of lecture-conversations upon the science of domestic economy. We are witness to-day to events where men, supposed to be worth millions of dollars, are stricken with bankruptcy as with the palsy, and reduced to poverty; and the evil results of such a calamity are often needlessly increased by an utter ignorance on the part of wives and daughters of the purchasing value of money and its uses as applied to household affairs.

We were present in the Köhler Kindergarten, at Gotha, at several of these interesting lectures, in which the professor discussed with his pupils every phase of domestic economy; and for the purpose of affording to American teachers the opportunity of fathoming its scope and simply as an illustration of method, and *not* for the absolute value of the suggestions, we shall quote the lectures in detail.

"Young ladies," says the professor, "suppose that you had to keep house, either as a wife or as a daughter, and that the family consisted of two grown members and three children, and that the income was

twelve hundred dollars a year, how would you spend it to the greatest advantage and comfort? If you had to reside in a rented dwelling, what kind of a house could you afford to lease? What proportion of this twelve hundred dollars, in justice to all other necessities and requirements, should be expended for rent? What number of rooms are essential? Would a garden be an advantage; and if so, how large? What are the prices of house rent in the City of Gotha?"

This field of inquiry seemed to be entirely new, and few pupils were prepared to answer. The professor then said: "Make inquiries; let us know how many rooms a family so circumstanced could afford, so as not to intrench too largely upon other necessary expenditures."

The next inquiry of importance is the question of nourishment. The professor said: "Ladies, for to-day's dinner," many of the pupils being boarders, "as you know, we had rice soup, beef, and vegetables for the first course, sausage and potatoes for the second, and pudding for dessert; can you tell me what was the cost of that dinner per person?" They could not. "What is the price of beef; what is the price of potatoes?" They did not know. "For to-day I will excuse you; but when we take up this subject again you must be better informed. Inquire of your mothers and friends, for it is of importance to you to know the value of the necessaries of life."

Coming back to the initial point—the annual income—the conversational lecture involved a thorough sifting of the details. Its chief value lay in its minute examination, so that every pupil could make either an additional inquiry or relevant suggestion. After a thorough canvass of the house rent question, the conclusion was reached that a family, with the income specified, could afford one hundred and fifty dollars per annum for house rent in that city. In other words, after surveying the whole field, the conclusion was reached that one hundred and fifty dollars house rent would be a proper proportion of the whole expenditure, and that any considerable increase of expenditure in that direction would tend to diminish the comfort of the family in matters equally essential.

The discussions of the question of proper nourishment and its relations to price, health, and comfort, were continued through a number of sessions. Not merely were the prices brought forward, but the questions, What kinds of food contain the most nourishment? How to secure a reasonable variety consistently with economy; and, How various dishes can be prepared and waste prevented, were treated in the same suggestive and familiar manner. In fact, these conversations were so genial, and withal so dignified, so pleasant, and, for girls, so interesting, that the pupils looked forward to them with anticipations of both pleasure and profit. Questions were submitted by pupils, and the zest with which the discussion was followed up showed that not merely was the topic in itself congenial, but that they appreciated its important relations to their future welfare. After a final and exhaustive review, it was determined that, with the existing prices of food in the City of Gotha, a family with the income stated could afford to spend three hundred dollars a year for food.

The next great question was the one of clothing. How shall we be clothed? The consideration of, What are the chief requisites for clothing? brought out a number of answers. The first one—Germany being a cold country—was, quite naturally, that it should afford the requisite warmth and protection in Winter. This was followed by the suggestions that it should be suited to the seasons; that it should be handsome in

appearance; unchangeable in color; of firm and durable texture. The wearing apparel of the grown members of the household was first considered; and the cost of silk, woolen, linen, cotton, broadcloth, and cassimere was discussed. The relations of colors to each other, and their correspondence with the complexion of the wearer, were also discussed, and in this field the ladies were able to contribute many interesting observations.

It was finally concluded, after a number of conversations, carried on twice a week, that three hundred dollars per year would clothe the family in a neat and respectable manner. Incidentally the question of making-over garments was brought up, and, strange as it may seem to us, that part of the question which treated of the limits to which remaking and turning can be carried with advantage, was brought prominently forward, for in that country careful women often go to the extreme of repairing and making-over garments when they no longer pay for the labor expended on them.

One feature upon which the professor dwelt most emphatically, was the ever-recurring incidental or extraordinary expenses of the family; and this is a matter of importance to both sexes and to all classes. The breaking of a pitcher does not happen every day, but in the aggregate there is an ever-recurring wear and tear of furniture and household goods, which, as the articles must be replaced at irregular periods, constitute what are called incidental or extraordinary expenses, though they are as truly ordinary expenses as any others. The keeping in repair of furniture and any other household necessaries requires an average expenditure of one hundred dollars per annum, and fifty dollars more may well be kept in reserve to meet the demand for literary and religious expenditures, and to provide for sickness, family presents, amusements, etc. In a growing family fifty dollars must be set apart for educational purposes; and the father may be considered an economic man if fifty dollars suffices for his incidental expenses, particularly if—as is the case with most Germans—he is addicted to the use of wine and tobacco. Fifty dollars are also needed for fuel, the economic use of which and the various kinds to be used formed an interesting and profitable topic. Finally, the expenditures foot up as follows:

For house rent	$150
For clothing	300
For food	300
For special expenditures	100
For extraordinary expenditures	50
For education	50
For fuel	50
For incidentals	50
Total	$1,050

This leaves about one hundred and fifty dollars as a savings fund, and is as little as ought to be saved in times of prosperity; for as children grow larger, and it may be desirable to send a son to the university, and as a family may increase and times may change, no man ought to spend regularly a larger portion of his income than is here set forth.

But many men in Germany have not an income of twelve hundred dollars. The great majority must live on eight hundred dollars, and even less. Let us, then, consider the question how a similar family can live on eight hundred dollars, remain out of debt, and be comfortable and respectable. The first question is, "Where can we retrench?" We must at once cut down the rent to eighty dollars per annum. We must retrench in the article of food; but the reduction here must not be too great, because a certain amount and quality are absolutely necessary to keep the family in good working condition. It will cost us two hundred and fifty dollars, at least. Then, we must dress plainly; we must use simple, strong woolen goods. This will enable us to reduce this expenditure to one hundred and eighty dollars. Thus all the household expenses are revised; and, while reënforcing previous lessons, these new discussions give to them a pleasant variety. These careful and well-digested reviews of the various phases of domestic economy are exceedingly attractive to the pupils, in part, doubtless, because they can ventilate the theories—which nearly every young woman cherishes in her heart—of domestic life.

In this manner a young woman becomes so thoroughly acquainted with the demands and details of domestic economy that she has well-defined ideas, based upon reality and reflection. Far from encouraging the husband and father—the purchasing power of whose income she knows—in extravagance, or in the waste of money in some particular direction, to the diminution of other necessary comforts, she will be prepared to resist temptation herself and to give sufficient reasons why the income should not be misdirected. Instead of looking upon marriage as a New Jerusalem, where troubles cannot intrude, she is prepared to bear her share of its great responsibilities and to assume a portion of its ever-increasing cares. Thus the woman becomes self-poised, firm in character, ready to adapt herself to the varying changes of fortune, and to meet with courage the vicissitudes of life. Her children will also be taught that frugality and economy, with the careful use of clothing and household goods, furnish the only sure way to prosperity.

Is not the average woman, when thus thoroughly equipped with a large store of practical information, better fitted to be a successful wife and mother than if her time had been taken up exclusively with the study of geometry and botany? Will she not be prepared to avoid the dangers of the bankruptcy of her husband and the terrible and harrowing course of "keeping up appearances," in which every comfort is sacrificed to the supposed requirements of social position?

We all know that the happiness of married life is worn out by the ever-recurring annoyances of little things. "Empty pots are filled with contention," is a proverb, in substance, of many nations, and the divorce courts are often called in as a last resort—and a most terrible one they are—when the struggle between the impecuniosity on the one hand, and desires for extravagant expenditure on the other, have turned the love of early days into gall and wormwood.

In view of these facts, so common that they must have come under the observation of all, it is to be hoped that these features of special female education will receive full and fair discussion, so that these new studies, with such modifications as experience shall suggest, may be introduced into our high schools and acadamies for advanced female pupils.

We are the more certain that these methods are deserving of recognition and adoption because the schools of the City of Gotha enjoy a high reputation upon the Continent. The seminary for the education of male teachers and the common schools, under the zealous care of School Director Dr. Möbius, and the Kindergarten Seminary, under Dr. Köhler, have earned so great a reputation that pupils from Greece, Russia, Hungary, and England, in increasing numbers, are being matriculated. This reputation for thorough and useful training is, moreover, based upon an unselfish devotion and a love for the cause as rare as it is delightful.

THE OBJECTS OF THE KINDERGARTEN.

THE THREE OBJECTS OF THE KINDERGARTEN.

In Germany, where the system has been tried for many years, the objects of the kindergarten have been considered under three heads: In the first place, it is to protect the children from the hurtful influences of nature, and from the corruptions of society; secondly, it is to provide the most improving kinds of play and occupation for children, as well as the purest, most devoted moral guidance, where that of the mother has been removed; thirdly, it is to afford the basis of cultivating the art of infant training, and a knowledge of the principles of education among women.

TO OBTAIN THE FIRST OBJECT,

A spacious, airy, dry room, with a garden attached to it, is to be procured by the united efforts of several neighboring families. Twelve will be found a convenient average number of children for one kindergarten. There should not be more than twice that number, nor fewer than half. From room and garden must be removed all objects that might injure the children during their play, or might be destroyed by them. The dress of the children must be simple, calculated to stand wear and tear. An incalculable amount of moral injury is kept from the children by the kindergarten, which removes them, at least for a part of the day, from persons unfit for infant training. All persons are unfit to educate who are themselves not educated, or educated badly. Therefore, domestic servants are, in general, unfit company for children, as was preached by Locke nearly two hundred years ago. In the case of mothers alone, and of the nearest female relatives, it may be supposed that love and instinct make up for the want of skill in education to a certain degree But the females who, as hired servants, have so much to do with the early training of our children, are notoriously incompetent in both respects. Their kindness is apt to turn into flattery, their strictness into cruelty. Many of them are abusive in language, vulgar in sentiment, in behavior, in everything. Their moral standard is generally low; their opinions and notions are disfigured by prejudice, ignorance, and superstition. Yet it is to these persons that we intrust our children at the very time that their natures are most tender and pliant, and when their dispositions are forming for good or for evil. It is one of the chief merits of the kindergarten system that it saves our little ones from being exposed to such influences; for uneducated females are expressly excluded from all share in their management. At the age in question, moreover, children are particularly unfit for being left to their own society, though they are so much the more benefited by being collected around their trainer. In one sense they are innocent, because ignorant of the distinction between good and evil, right and wrong.

Allow them to congregate as an untended flock, and there shoots forth a growth of rank passions, anger, violence, cruelty (particularly to animals), destructiveness, jealousy, cowardice, and folly. But bring these children together, with their minds turned, not against each other, but toward the superior mind of an educated person among them, who has food for their minds, who gives them games and improving occupations, whom, therefore, they love and revere, and their natures seem changed—the animal part tamely serves the angelic. Such is the process of the kindergarten. It is the garden in which the drone part in man is to be cultivated from infancy.

THE SECOND AND POSITIVE OBJECT

Of the kindergarten is to supply the children with the favoring influences of nature and civilization, and to secure for them the best moral guidance. Of the natural objects which should surround children the most beneficial will be the garden, with grass plat, graveled walks, some banks of sand, clay, or mold, some water, stones, vegetation, more or less, according to circumstances. A supply of natural products for play-material, such as leaves, flowers, seeds, shells, feathers, pebbles, sticks, thorns, barks, moss, etc., will be collected in walks with the children. There is nothing that gives children more improving pleasure than little foraging expeditions, which, indeed, form an important part of the system. It is wonderful to what an infinite variety of purposes such material will be put, spontaneously, by the children; how much inventive power will be developed, and how useful all this may be made for a knowledge of nature at a later stage.

More important for later scientific knowledge are the artificial products which are to serve as playthings. Ready-made toys are almost entirely excluded from the kindergarten, and should be nearly so from the nursery. Their influence is of little value for children, as that of ready-made truths and opinions for adults, in matters in which they ought to be enabled to judge for themselves. The best use that children generally make of toys is to break them, to examine how they are made and what they are composed of, and to make of them something to their own taste. For such naughtiness, which, however, cannot happen in the kindergarten, they are, of course, punished in the nursery. Something ready made, however, is necessary, only it should be simple, and not too plentiful. The kindergarten gives what is required in the shape of cubic bricks, tablets of wood, little sticks of certain proportionate lengths for laying figures, or sharpened to be stuck into softened peas, for forming the shapes of crystals and other structures, paper for folding and cutting out figures and ornaments, clay for modeling, scissors, harmless knives, slates, pencils, and other similar things. Here, also, it is quite wonderful to see what little children will make out of the old nursery *regime*, how skillful their little hands become, and how much more their minds are intent on constructing than on breaking them. But when the play-room, the garden, and playthings are provided, success will still depend on the manner in which they are used, and therefore on the person who conducts the children's occupations. For the most grateful, though by no means easy duty, a class of persons must be secured who are naturally fond of children, and inclined to enter into their feelings; who easily perceive their wants and are rich in resources to supply them; persons of a pure, loving heart, a cultivated mind, and possessed of the accomplishments which grace our educated females; for they must be able to sing songs, invent games, tell stories, and draw pictures to illustrate them, know something about natural history, have a distinct notion of the powers of the human mind, and the general laws of their development, and understand the principles of moral philosophy—at all events, sufficient to know that a little child must not be treated too early as a responsible agent, and can hardly deserve punishment any more than an animal or a table. By such knowledge alone can the gross mistakes so commonly committed in the training of children be avoided.

AN APPROPRIATE WORK FOR YOUNG AND ACCOMPLISHED WOMEN.

Excepting mothers, no other class of persons can be more fit or worthy to reign in the kindergarten than the well-educated and accomplished young ladies of modern society—the very class with whom at present we do not know what to do. Social science is clamorous in demanding for a large portion of that class a more useful employment than to wait for husbands.

Let the kindergarten system become general, and proper employment is found, to the great benefit of every future generation. It may, with reason, be maintained that every able-bodied man should be prepared to be a soldier; every female should be equally qualified to educate children. The country has not always enemies to be killed, but it has always a young generation to be reared. Rank makes no exception to the soldier; so ought also the claim on the female sex to train up the new generation be general. In whatever rank the kindergarten be established, its training will be worthy of an offspring destined to become free moral agents, conscious of immortality. In Germany, the land of education, it has, from its beginning, been favored by the great of the land. The mother of the Count de Paris took her little son to a kindergarten near Eisenach, in which he received some of his earliest education. And even princesses have, in the kindergarten, tried their hand at infant-training.

THE THIRD OBJECT OF THE KINDERGARTEN.

In the third place, then, the kindergarten is to form the basis of cultivating the art of infant-training and the knowledge of the principles of education among women. And because education, physical, moral, and intellectual, cannot be made an object of study in books, the kindergarten has suggested the plan of connecting with normal institutions this highest or finishing education of the female sex. Where there are favorable localities there are to be established model kindergartens for practical demonstrations of the system, and courses of lectures should be delivered to all female students, in all branches bearing upon the education of children, both within and beyond the limits of the kindergarten. And what sciences and arts do not bear upon this subject? If there be some minimum of knowledge and proficiency in a subject that must be possessed before it can be taught, there is no maximum that may be surpassed. The ability to sing a little song well, and accompany the children on the piano, which belongs to the kindergarten, will not be impaired by such proficiency as will do for the drawing-room; to draw on a school-board a scene including animals and persons, composed, of course, or arranged by herself, though not requiring the talent of a Rosa Bonheur, may test the skill of an artist. To make a set of

little toys from the five regular solids, with sticks stuck into softened peas, and likewise pyramids, prisms, plane figures, etc., and give them the right names, as to divide a cube into its fractional parts, and let the children perceive that one eighth is exactly two fourths—these mathematical plays, the most improving of the kindergarten, demand a knowledge of geometry—the sounder the better. Why do young ladies learn geometry? Here is a useful and worthy object. But there is much more to be done. Children will as easily learn French and German songs in the kindergarten as to talk French and German in the nursery. Then there are a thousand questions to be answered about matters of natural history and physics. Why does the brook always *flow? where does it run? What is the moon? why does it shine? where* does it go? What is the wind? What makes the waves of the sea? What is the use of this plant? Why does a ball fall; a soap bubble rise? Why do flowers stuck in the sand wither so soon? Where does this animal live? If not snubbed and stunted by being told not to ask foolish questions, there is no limit to the intellectual craving of a young child. The wisdom of the deepest philosopher may be insufficient for answering some of these questions, but a judicious reply, striking out the first spark of reflection, may start the germ for the later researches of a *Newton*.

WHAT IS REQUIRED OF THE TEACHERS.

The most essential part of the whole system is the methodical arrangement of the exercises and the games, and the explanations given by Froebel to those who are to conduct them. To know them all is quite a study; to apply them well, an art; to understand their significance, their effort, the order and manner in which they ought to be given to the children, is a science. The young trainer must know what to select from the great store to suit the different ages, how long to continue one exercise so as not to overstretch the faculties. There is great power united in her hands, and, not to misuse it she must well understand the infant nature on which it is exercised.

THE DEVELOPMENT AND PERFECTION OF THE INDIVIDUAL.

The kindergarten involves the best of the Pestalozzian system, and some of Froebel's principles were already laid down by Locke. The kindergarten is one of the consequences of that principle of modern education which aims at the perfect cultivation of the human individual, individual perfection. This is to be the grand result of education; and the way to it, the method, is the free development of the mental faculties. Froebel saw this principle enjoined in Christianity, "Be ye therefore perfect, even as your Father in Heaven is perfect," and considered his system eminently Christian. He tried to carry out the developing method into all branches of instruction, first in the school at Keilhau, and afterward applied it to infant training. This method may be defined as education, guided by the true knowledge of human nature, as by the philosophy of the human mind. A little of that knowledge shows that the education of the youngest requires the greatest skill, because everything belonging to their education must be done for them, while, as they grow older, they learn more and more to educate themselves, till, at the age of manhood, they are left to self-education. Thus as young people grow older the educator has less and less to do for them. When, with the sixth or seventh year, the child begins to reflect, he is capable of

conceiving general purposes, though in particular cases, and of employing means for them, that is, of working. His trying to get and use means for ends is learning, and fits him for the school. The occupations of the kindergarten are merely a playing at school, and in this sense the kindergarten is a *play school*, in which, if children are not exactly taught to play, they are guided *how* to play. They are full of activity, and all that is wanted is the supply of proper material and liberty to exert their powers upon it; these powers are summed up in imagination, first betrayed by the impulse of the will to produce some effect, and then defined by imitation. The first plays are imitations of motions and actions which the children have perceived, and which the *trainer takes advantage of in order to teach them graceful motions of* their limbs and bodies. Of the quiet games, the most simple are those with the natural products obtained from their walks. Next come those with the divided cube, for which each child is supplied, first, with a box containing eight cubes, then with one containing eight bricks, then one with some diagonal sections, then one with some diagonal sections of cubes, and lastly one of bricks with subdivisions. These blocks are first applied to the construction of familiar objects, as houses, chairs, tables, everything which may be included under the forms of use, and which are interesting even to the youngest. The forms of beauty and symmetry require more sense, but are found to be inexhaustibly attractive. And last of all come the forms of knowledge, which familiarize them with the geometrical properties of the cube, and the names of its sides and lines. Then tablets are introduced, some of equilateral, some of triangular shape, which impress them with the peculiarity of the numbers three, six, nine, as squares do with the numbers two, four, eight. At last, sticks and peas, or sticks alone, serve as material for forms of use, of beauty, and of knowledge. The latter may lead far into a knowledge, of course merely intuitive, of geometrical relations and laws. The use of sticks disciplines the eye for drawing, which also requires skillful manipulation of the pencil. The age from three to seven years seems to be the period of fantastic invention, in which latent genius is developed, and which may be compared with the plowing and sowing season of husbandry. This most important season of childhood is, how often, allowed to pass neglected. Poor children in the country are often better provided with right occupations than the children of the rich, which may in some measure account for the genius which springs up in country colleges. It will thus be observed that the material given to children is at first the most natural, and is followed by the more and more artificial. The latter, again, is given at first in the most simple and palpable shape, and is followed by representations of abstractions more and more removed from the concrete. The highest intellectual effort in the kindergarten is the Pestalozzian form of drawing on slates or drawing in books ruled over with small squares. This drawing, though entirely under the rule of imagination, prepares for proper drawing, for writing, and for geometry, better than anything else. Children, at an early age, become excessively fond of it; consider it quite an amusement, and yet will work at it an hour without getting tired, so that it may be necessary to check their eagerness. Of poetry, accompanied by music, great use is made in the kindergarten, which offers a most extensive field for the poetical and musical genius of ladies who love children, and the pure joy of their paradise. In Germany, Hoffman Van Fallersleben has shown, by his "Kinderlieder," that verses which please little children may have poetical charms for every

period of life, and some of the best composers have added to the beauty of the words by their graceful composition. The first visible effect of a well-conducted kindergarten on the children is that it tames them. They soon evince that their happiness is increased. Though more gentle they become more lively. Their affection for their trainer, the kindergarten, is great, yet their love to their parents does not seem to diminish. It is found that at home they are much more quiet, because they soon find a quiet amusement and eagerly engage in it. The genial occupation of their brain, combined with the bodily exercise and the happy humor in which they seem to be, for hours, when in the kindergarten, cannot but favor an increase of their natural faculties.

A generation that has passed though the developing system which begins in the kindergarten will have learned self-command or virtue, will be possessed of pure and genuine taste, and will be self-dependent both in thought and action. As a striking testimony to this effect, we may take the proceedings of the Russian Government against that system since eighteen hundred and fifty. Fichte, in his addresses to the German nation, has recommended national education on the developing system. John Jahn applied it to physical education by his "Turnwesen," or gymnastics, which quickly spread over Germany, and was as quickly put down as politically dangerous. Froebel tried to apply it to general education, but the German Governments, particularly Austria and Prussia, were frightened at the spirit of independence from which the system proceeded and which it fostered. Prussia, receding more and more from her glorious efforts of eighteen hundred and thirteen, almost eradicated the developing principle from her national education, once so renowned. But a better spirit is alive again in Germany. "Turnen" is again flourishing, and national education, on the developing principle, again appears as one of the great objects of interest to the German nation. Consequences of the kindergarten system on the female portion of the population will proceed from two sources at once: from the better training of children, and from the complete education of those who are to train them. The advantages of a system which places infant training in the hands of educated women can, perhaps, not be too highly estimated.(1)

EXPLANATORY NOTE OF THE PLAN OF THE EXERCISES IN THE KINDERGARTEN.

The time of occupation in the kindergarten is three or four hours on each week-day, usually from nine to twelve or one o'clock; the changes from one to another occupy from twenty to thirty minutes. It is worthy of remark that the arrangements and furniture must have a special adaptation to the method of teaching. Thus, for instance, the desks are covered with lines, which make squares of an inch; this teaches the child to arrange his material in an orderly manner. However, all occupations that can be engaged in out-of-doors should be carried on in the garden, whenever the season and weather permit. The character of the plays is such that some instruction is combined with the amusement, for pleasant games introduced are almost always accompanied by singing. There are movement plays, so called, symbolic plays, in which the forces of nature are introduced, as in the games of

(1) The foregoing article has been prepared partly from the writings of Carl Froebel.

the wind-mill and the water-wheel, etc., or the children imitate the flying of birds, the swimming of fish, etc., or they represent the different tradesmen, as the cooper, miller, farmer, etc., for instance, the motions of sowing, mowing, thrashing, etc. By all these and similar plays the relation of one to another is brought out, and in this way they get connected ideas. It should be mentioned that the children in the kindergarten are never left to themselves, neither during the play exercises nor the time devoted to other occupations. There is nothing of that rude, aimless playing and screaming so common at recess-time in so many ordinary schools.

It is impossible to give a plan for all existing kindergartens, as they are unlike in their arrangements. In small places the time of occupation is during the forenoon and afternoon; this is also the case with the poor children in large cities, as it is a blessing for them to remain as long as possible under the good care of the institution. The plan of occupation is not only dictated by local circumstances but also by the seasons. The Winter requires another arrangement than the Summer. The children are divided, according to their age, in two divisions, as not all the exercises for children from five to seven years old can be comprehended by children from three to five. The following order of exercises is from Lina Morgenstern's Paradise of Childhood.(1) I should not forget to mention that the kindergarten furnishes all the material.

SCHEDULE OF EXERCISES FOR A KINDERGARTEN, WINTER AND SUMMER.

WINTER OCCUPATION.

Monday.—9 to 9½, coming, arranging; 9½ to 10, recitation or song; 10 to 10½, telling stories; 10½ to 11, building; 11 to 11½, eating; 11½ to 12, ball-plays; 12 to 12½, puncturing paper; 12½ to 1, movement plays.

Tuesday.—9 to 9½, coming, arranging; 9½ to 10, recitation, song; 10 to 10½, telling stories; 10½ to 11, weaving or braiding; 11 to 11½, eating; 11½ to 12, ball-plays; 12 to 12½, paper cutting and mounting; 12½ to 1, movement plays.

Wednesday.—9 to 9½, coming, arranging; 9½ to 10, recitation or song; 10 to 10½, learning a song; 10½ to 11, drawing; 11 to 11½, eating; 11½ to 12, ball-plays; 12 to 12½, peas-work; 12½ to 1, movement plays.

Thursday.—9 to 9½, coming, arranging; 9½ to 10, recitation, etc.; 10 to 10½, telling stories; 10½ to 11, building; 11 to 11½, eating; 11½ to 12, ball-plays; 12 to 12½, puncturing paper; 12½ to 1, movement plays.

Friday.—9 to 9½, coming, arranging; 9½ to 10, recitation, etc.; 10 to 10½, telling stories; 10½ to 11, weaving or braiding; 11 to 11½, eating; 11½ to 12, ball-plays; 12 to 12½, paper cutting; 12½ to 1, movement plays.

Saturday.—9 to 9½, coming, arranging; 9½ to 10, recitation, etc.; 10

(1) Compare "Das Paradies der Kindheit nach Friedrich Froebels Grundsätzen" von Lina Morgenstern Paradise of Childhood, according to the principles of F. Froebel, by L. Morgenstern. Berlin, 1865.

to $10\frac{1}{2}$, repetition of the songs; $10\frac{1}{2}$ to 11, drawing; 11 to $11\frac{1}{2}$, eating; $11\frac{1}{2}$ to 12, ball plays; 12 to $12\frac{1}{2}$, working in clay; $12\frac{1}{2}$ to 1, movement plays.

SUMMER OCCUPATION—FIRST DIVISION.

Monday.—9 to $9\frac{1}{2}$, coming, arranging; $9\frac{1}{2}$ to 10, telling stories, conversation on objects; 10 to $10\frac{1}{2}$, drawing; $10\frac{1}{2}$ to 11, eating; 11 to $11\frac{1}{2}$, work in the garden; $11\frac{1}{2}$ to 12, movement plays; 12 to $12\frac{1}{2}$, free occupations; $12\frac{1}{2}$ to 1, concluding prayer.

Tuesday.—9 to $9\frac{1}{2}$, coming, arranging; $9\frac{1}{2}$ to 10, conversation on objects; 10 to $10\frac{1}{2}$, folding and interlacing; $10\frac{1}{2}$ to 11, eating; 11 to $11\frac{1}{2}$, work in the garden; $11\frac{1}{2}$ to 12, movement plays; 12 to $12\frac{1}{2}$, free occupations; $12\frac{1}{2}$ to 1, concluding prayer.

Wednesday.—9 to $9\frac{1}{2}$, coming, arranging; $9\frac{1}{2}$ to 10, conversation on objects; 10 to $10\frac{1}{2}$, peas work; $10\frac{1}{2}$ to 11, eating; 11 to $11\frac{1}{2}$, work in the garden; $11\frac{1}{2}$ to 12, movement plays; 12 to $12\frac{1}{2}$, free occupations; $12\frac{1}{2}$ to 1, concluding prayer.

Thursday.—9 to $9\frac{1}{2}$, coming, arranging; $9\frac{1}{2}$ to 10, conversation on objects; 10 to $10\frac{1}{2}$, weaving and braiding; $10\frac{1}{2}$ to 11, eating; 11 to $11\frac{1}{2}$, work in the garden; $11\frac{1}{2}$ to 12, movement plays; 12 to $12\frac{1}{2}$, free occupations; $12\frac{1}{2}$ to 1, concluding prayer.

Friday.—9 to $9\frac{1}{2}$, coming, arranging; $9\frac{1}{2}$ to 10, conversation on objects; 10 to $10\frac{1}{2}$, puncturing and cutting paper; $10\frac{1}{2}$ to 11, eating; 11 to $11\frac{1}{2}$, work in the garden; $11\frac{1}{2}$ to 12, movement plays; 12 to $12\frac{1}{2}$, free occupations; $12\frac{1}{2}$ to 1, concluding prayer.

Saturday.—9 to $9\frac{1}{2}$, coming, arranging; $9\frac{1}{2}$ to 10, conversation on objects; 10 to $10\frac{1}{2}$, building; $10\frac{1}{2}$ to 11, eating; 11 to $11\frac{1}{2}$, work in the garden; $11\frac{1}{2}$ to 12, movement plays; 12 to $12\frac{1}{2}$, free occupation; $12\frac{1}{2}$ to 1, concluding prayer.

SUMMER OCCUPATION—SECOND DIVISION.

Monday.—9 to $9\frac{1}{2}$, coming; $9\frac{1}{2}$ to 10, prayer, telling stories; 10 to $10\frac{1}{2}$, building and laying figures; $10\frac{1}{2}$ to 11, eating; 11 to $11\frac{1}{2}$, work in the garden; $11\frac{1}{2}$ to 12, movement plays; 12 to $12\frac{1}{2}$, free occupations; $12\frac{1}{2}$ to 1, concluding prayer.

Tuesday.—9 to $9\frac{1}{2}$, coming; $9\frac{1}{2}$ to 10, prayer, recitation; 10 to $10\frac{1}{2}$, weaving and paper folding; $10\frac{1}{2}$ to 11, eating; 11 to $11\frac{1}{2}$, work in the garden; $11\frac{1}{2}$ to 12, movement plays; 12 to $12\frac{1}{2}$, free occupations; $12\frac{1}{2}$ to 1, concluding prayer.

Wednesday.—9 to $9\frac{1}{2}$, coming; $9\frac{1}{2}$ to 10, prayer, telling stories; 10 to $10\frac{1}{2}$, puncturing and drawing; $10\frac{1}{2}$ to 11, eating; 11 to $11\frac{1}{2}$, work in the garden; $11\frac{1}{2}$ to 12, movement plays; 12 to $12\frac{1}{2}$, free occupations; $12\frac{1}{2}$ to 1, concluding prayer.

Thursday.—9 to $9\frac{1}{2}$, coming; $9\frac{1}{2}$ to 10, prayer, telling stories; 10 to $10\frac{1}{2}$, building and laying; $10\frac{1}{2}$ to 11, eating; 11 to $11\frac{1}{2}$, work in the garden; $11\frac{1}{2}$ to 12, movement plays; 12 to $12\frac{1}{2}$, free occupations; $12\frac{1}{2}$ to 1, concluding prayer.

Friday.—9 to $9\frac{1}{2}$, coming; $9\frac{1}{2}$ to 10, prayer, telling stories; 10 to $10\frac{1}{2}$, weaving and drawing; $10\frac{1}{2}$ to 11, eating; 11 to $11\frac{1}{2}$, work in the garden; $11\frac{1}{2}$ to 12, movement plays; 12 to $12\frac{1}{2}$, free occupations; $12\frac{1}{2}$ to 1, concluding prayer.

Saturday.—9 to $9\frac{1}{2}$, coming; $9\frac{1}{2}$ to 10, prayer, recitation; 10 to $10\frac{1}{2}$, drawing, ball plays; $10\frac{1}{2}$ to 11, eating; 11 to $11\frac{1}{2}$, work in the garden;

$11\frac{1}{2}$ to 12, movement plays; 12 to $12\frac{1}{2}$, free occupations; $12\frac{1}{2}$ to 1, concluding prayer.

JOHN KRAUS.

PROGRESS OF KINDERGARTEN CULTURE IN AMERICA AND ELSEWHERE.

The following is a brief abstract of a report made by Miss Elizabeth P. Peabody upon the progress of kindergarten culture, the limits of this volume forbidding the publication of the article in full.

OBSTACLES TO THE ESTABLISHMENT OE KINDERGARTEN SCHOOLS.

The progress of the genuine kindergarten, *versus* ignorant attempts at it, has not been very great in America, for the reason that the public is not yet prepared to sustain attempts at establishing such schools, and there are not yet sufficient facilities for the education of teachers of the genuine kindergarten. Private munificence is necessary to sustain such attempts at reform in education until their value shall be demonstrated. The history of the first establishment of normal schools proves this. After ten years of lecturing by Rev. Charles Brooks, of Medford, and Hon. Horace Mann, to prepare the people to appreciate the necessity of normal schools, it was still necessary for a private citizen to offer ten thousand dollars, on condition that the Legislature should grant an equal sum, before the first normal school could be instituted; and, moreover, at its first opening, the intelligent State of Massachusetts furnished only three young women who desired to improve by its advantages.

KINDERGARTEN NORMAL TRAINING.

The first and only kindergarten normal school established in this country is that in Boston, taught by two German-American ladies, whose very religion it is to educate children according to Froebel's system. This is a private class, and is taught by lectures and practice in a model kindergarten. More than twenty five teachers have completed their training here, although fully half of this number have been obliged to incur debt in so doing; and, after all, they have been severely tried by finding the public unprepared to understand or appreciate their system, so different is the old idea of that which a child should first learn from the inspiration of Froebel, namely, that the true order of the unfolding of human nature is first doing, and afterward thinking, because the child will attend at first only to what himself does.

THE TEACHERS' TEMPTATION.

But the ignorant and impatient ambition of parents makes a sore temptation to teachers even of the most unmercenary spirit. It is easy to *please* parents and gratify their vanity by *showing* children the way to do things, instead of addressing their own active power by words fitly chosen, that the young teacher is tempted to do it, letting the child make and do things with no more intellectual movement than accompanies a monkey's imitations.

PUBLIC APPRECIATION DEMANDED.

To diffuse throughout the country a proper public appreciation of the kindergarten principle, producing a deferential coöperation with the educated kindergartener, instead of a tormenting and obstructing criticism, and to afford young women an opportunity for attaining this most beautiful of the fine arts (because its material is the highest), well-endowed public normal schools for it are indispensable, where those who feel the vocation can have instruction free. The Boston school that has been mentioned above will, it is hoped, be adopted as an independent department of the city normal school, since, in Boston, a beginning has been made by the School Committee of eighteen hundred and seventy, who established one kindergarten in the public system.

PROPOSED EXPERIMENTAL SCHOOL IN NEW YORK.

In New York, it has been proposed by the Commissioners of Education, who have a term of five years to work in, to make one of three experimental schools a normal school, with its model kindergarten attached.

FRAGMENTARY INSTRUCTION.

A German lady in California, Mrs. Weddigen, has done some good work in keeping a kindergarten, under every imaginable disadvantage, and without any intelligent coöperation, and has also lectured and written upon the subject.

Another person, who has done very much, especially among the German population in and about New York, is Dr. Adolph Douai, who has now an institute in Newark, New Jersey. He imported a trained teacher from Hamburg, at great expense, to instruct his daughter in the art, and though he has varied a little from the method of Froebel, especially in the art of drawing, his kindergarten should not be characterized as a false one.

Miss Louisa Frankenburg, an old lady of seventy, who was the pupil and friend of Froebel, now resident at Germantown, Pennsylvania, has instructed some superior ladies in the art, and feels still capable of doing so, notwithstanding her age. She has made some efforts to assist intelligent colored women to obtain the kindergarten training, but the efforts hitherto failed, from lack of appreciation by the public.

KINDERGARTEN MATERIAL.

A gentleman, of Springfield, Massachusetts, has established a manufactory of kindergarten material, a truly public-spirited act, since he does not expect even to get his money back for years.

KINDERGARTEN IN EUROPE.

The only place where Froebel commenced his kindergarten work triumphantly was in Hamburg, whither he was invited by a remarkable society of ladies, half of them Christians and half Jewish, who had associated for the purpose of producing religious toleration, and who naturally became a radical education society. In this city, the widow of Froebel now has a kindergarten. In Dresden, Frau Marguadt keeps an admirable kindergarten. But the best in the world is, perhaps, Madame Vogler's, in Berlin. At this moment there is in Germany a new impulse toward genuine kindergarten culture in the highest intellectual classes. The Philosophers' Congress, which met in Prague, Bohemia, in eighteen hundred and sixty-eight, and at Frankfort-on-the-Main, in eighteen hundred and sixty-nine, has made it a special object to investigate Froebel's system, and has pronounced it the most advanced on the subject of education.

ITALY AND ENGLAND.

It is an interesting fact that the kindergarten is about being made the first step of the new public school system of Italy, which is superseding the old ecclesiastical schools hitherto prevalent there.

The Italian Minister of Instruction, having become interested in kindergartenry, has imported some German kindergartens into Italy, and also sent some Italian girls to be taught in the normal schools of Berlin.

An English lady says that Manchester and London are almost the only towns where kindergartens have taken root, though there have been isolated attempts and partial success in some other places. Miss Praetorius, a woman thoroughly skilled in the art and science of Froebel, says that there is not a genuine kindergarten in England. A visitor to her school, in which I have passed a few hours, may, however, see the most perfect teaching of singing to children in the world.

ELIZABETH P. PEABODY.

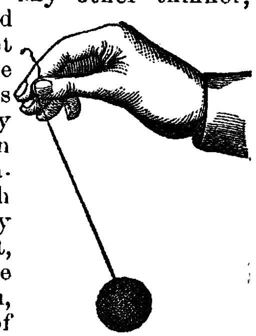
THE KINDERGARTEN.

[An address delivered April 3d, 1875, before the Normal Teachers' Association, at St. Louis, Missouri, by MISS S. E. BLOW.]

It is a truth now universally recognized by educators, that ideas are formed in the mind of a child by abstraction and generalization from the facts revealed to him through the senses; that only what he has himself perceived of the visible and tangible properties of things can serve as the basis of thought, and that upon the vividness and completeness of the impressions made upon him by external objects, will depend the clearness of his inferences and the correctness of his judgments. It is equally true, and as generally recognized, that in young children the perceptive faculties are relatively stronger than at any later period, and that while the understanding and reason still sleep, the sensitive mind is receiving those sharp impressions of external things, which, held fast by memory, transformed by the imagination, and finally classified and organized through reflection, result in the determination of thought and the formation of character.

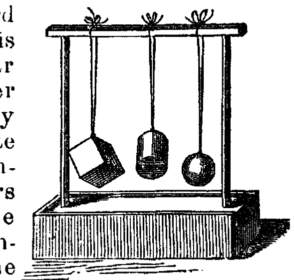
These two parallel truths indicate clearly that the first duty of the educator is to aid the perceptive faculties in their work by supplying the external objects best calculated to serve as the basis of normal conceptions by exhibiting th se objects from many different standpoints, that variety of interest may sharpen and intensify the impressions they make upon the mind, and by presenting them in such a sequence that the transition from one object to another may be made as easy as possible.

The advocates of the kindergarten believe that Froebel has met this fundamental necessity in education better than any other thinker, and that the series of objects technicallly called Froebel's Gifts, offer the healthiest nourishment yet discovered for the child's mind, and constitute the best basis yet known for strong and harmonious development of the intellectual powers. It is my purpose to-day to describe these gifts briefly, in the order of their succession, to indicate their connection, and to try to make clear the law by which their sequence is determined. Recognizing clearly the necessity of a definite starting point for thought, Froebel presents to the child in his First Gift the ball, an object containing, under the simplest form, the properties common to all things. By means of the ball we illustrate the general properties of size, color, form, weight, and density, while at the same time we give the child the easiest thing in the world to grasp alike with the hand and the mind. It is the simplest of forms, for it has neither sides, corners, nor edges. It is easy to conceive



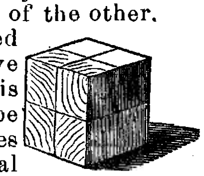
as a whole, for in all positions it appears the same. It is the fundamental form throughout nature, and is constantly appearing both in the organic and inorganic worlds, and, finally, it is perfectly harmonious, being, one might almost say, the ideal form towards which the universe strives. To the child, moreover, the ball is the source of infinitely varied amusement. He rolls it, he tosses it, he whirls it round and round. Holding it by a string, he moves it up and down, right and left, round in an ever-widening or an ever-narrowing circle. It becomes to him the representative of a thousand things; through its form it stands for the fruits and flowers he has learned to love; through the motions he gives it, it becomes to him the springing cat, the flying bird, the climbing squirrel—all the objects with which his little experience of life has made him familiar, are embodied in it, and just from its great simplicity result its manifold adaptations.

As introduced into the kindergarten, the First Gift consists of a box containing six soft worsted balls of the different primary and secondary colors. These balls should be so used that the child will learn through actual experience all their essential characteristics, both in rest and in motion, in their relation to each other, and in relation to himself.



The Second Gift, which consists of a hard ball, a cube, and a cylinder, involves at its basis recognition of the truth that in order to clear knowledge there must be comparison, or, in other words, that we only learn what a thing *is* by learning what it *is not*. Therefore, to complete the child's knowledge of the ball, he must compare it with something else, and as his powers are too weak to discern slight divergencies, he needs an object which presents to it the completest possible contrast. This we find in the cube. Instead of the unity of the ball, we have in the cube variety; instead of the simplicity of the ball, we have in the cube complexity; instead of the unvarying uniformity of the ball, we have in the cube an object which changes with every modification of position, and every acceleration of movement—instead of the ready movableness of the ball, we have in the cube an object which, as it were, embodies the tendency to repose.

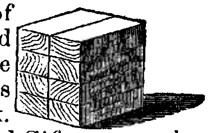
The cylinder forms the connecting link between the ball and the cube. Like the ball, it is round and without corners, and like the cube, it has sides and edges. It contains the ball, and is contained by the cube, and it unites the movableness of the one with the fixedness of the other.



In the Third Gift, which consists of a cube divided once in every direction, giving eight smaller cubes, we pass from contrasts of form to contrasts of size. This gift, considered as a whole, is identical with the cube of the Second Gift, but through its divisions it enables the child to grasp inner conditions as well as external appearance, leads from the conception of a simple unit to the elements of which such unit is composed, thus paving the way for rational analysis. And as every analysis should end in a synthesis, every condition of the cube into its parts is followed either by their recombination into the original whole, or by the production of a new whole, of which each small cube is again an essential part. Thus the Third Gift meets the instinctive craving of the child to find out what is inside of things, and

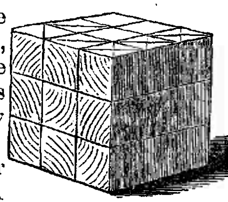
at the same time, through the number and variety of its possible transformations, it satisfies and stimulates the creative powers. This gift is also excellently adapted to give children definite ideas of number, and only those who have seen the little calculators making all possible combinations of their eight cubes, can understand how the experiences thus obtained will simplify arithmetic, and make it a pleasure instead of a torture, alike to teacher and pupil.

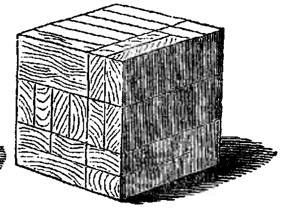
The Fourth Gift, like the third, is a divided cube, but in its subdivisions we have blocks, whose sides are oblongs instead of squares. And whereas, in the small cubes of the Third Gift, the length, breadth, and thickness were equal, the parallelopipeds of the Fourth Gift are twice as long as they are broad, and twice as broad as they are thick.



Thus the three dimensions of space implied in the Third Gift are emphasized in the fourth, and all the possibilities latent in the former are actualized in the latter.

As all development moves from the simple to the complex, and as in the child what is new unfolds from the old, so in the kindergarten gifts which are intended to be an objective counterpart of this subjective process, we find each new gift contains all that existed in the previous gifts, with the addition of elements which they implied, but did not realize. Thus in the Fifth Gift we again have the cube—this time, however, the cube is larger—the number of its parts is greatly increased, and by dividing some of the smaller cubes, the triangular form is introduced. A



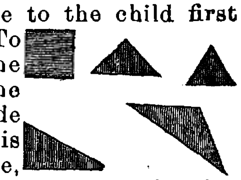


greatly increased amount of material is thus put into the hands of the child, and alike in extended numerical relations, in variety of fundamental forms, and in adaptability to creative purposes, this gift is an advance upon its predecessors. With the Sixth Gift, which is a cube of the same size as the fifth, but differs in its subdivisions, we complete the series of solid forms.

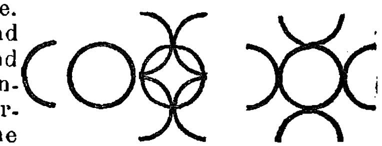
To understand these gifts we must clearly and definitely apprehend their relation to each other, for it is this relation which gives them their significance, and upon the recognition of this relation depends the power with which they are used. We conceive nothing truly so long as we conceive it alone. It is only when the relations of any individual object to universal law are rightly apprehended, that a clear insight into its nature is gained. Now the universal law of development is progress from the unlimited to the limited, from the homogeneous to the heterogeneous, from simplicity, with its manifold adaptations, to complexity, with its defined parts and restricted powers. Illustrations of this law are all around us. It is written on all inorganic nature; it unfolds itself yet more clearly in the plants and animals. Man, too, is no exception to it, but physically, mentally, and morally progresses under the conditions which it imposes. Clearly the law of human development should be the law of education, and the great originality of Froebel as a thinker consists in his recognition and application of this vital truth. It was this underlying thought which determined in his mind the sequence of the six gifts just described, and any person who will carefully study them, will find that there is in them a gradual

advance in definiteness and complexity, and that each successive gift limits the freedom of the child, while vastly increasing his power within the boundaries defined.

Education, however, must move not only from the simple to the complex, but from the concrete to the abstract. Hence in Froebel's Seventh Gift we pass from the solid to the surface, and give to the child first squares, and then the different kinds of triangles. To preserve the connection of the gifts and to derive the surface, as, logically, it must be derived from the solid, the square is represented as the embodied side of the cube. The right angled isosceles triangle is then derived from the square by the diagonal line, and with this triangle as the standard of comparison, the other triangles are also illustrated and defined.



The interlacing slats of the Eighth Gift form the transition from the surface to the line. These slats rudely represent the line, while, by breadth, they are still connected with the surface. They are succeeded by the sticks and wires which visibly embody the line, and through which the child learns to conceive the line as the boundary of a surface, just as he previously conceived the surface as the boundary of a solid. The limit of analysis is reached when we move from the line to the point, and in Germany there has recently been introduced into some of the kindergartens the occupation of sorting, arranging, and combining into different forms, small pebbles or shells, which are intended to represent the embodiment of the point. The sorting of seeds for the gardens also comes under this head, and with these crude material representations of the point is completed the series of kindergarten gifts.



I trust from what has been said that the following points with regard to these gifts have been clear:

1. That the method of procedure—by which the successive links in the series are obtained—is strictly analytical. Thus, by analysis of the solid we obtain the surface, by analysis of the surface the line, by analysis of the line the point.

2. That in using these gifts the child effects no transformation of material; he neither adds to, diminishes, nor modifies what is given to him, but simply classifies, combines, and arranges the elements he receives.

We pass, now, from the kindergarten gifts to the kindergarten occupations, and, before I attempt to explain these, I wish to correct the generally prevalent idea that they are only mechanical employments, and that their purpose is simply to train the hand of the child, and to serve as a foil to the more intellectual exercises with the solid and plane geometric forms. The kindergarten is not a school, where lessons are alternated with fancy work, and there is no broad distinction between gifts involving more or less intellectual effort and occupations implying principally mechanical neatness of execution. The occupations of the kindergarten are based upon the same general laws and regulated by the same general principles which apply to the gifts, and

their effect upon the total harmonious development of the child is even more striking than the effect of the blocks, squares, triangles, and sticks, to which they are sometimes most injudiciously subordinated.

The true distinction between the gifts and occupations is, that while the former are derived by analysis from the solid, the latter are evolved by synthesis from the point, and while in the former the child simply makes different combinations of definitely determined material, in the latter there is progressive modification and transformation of the material itself. Thus, from pricking where all kinds of harmonious figures are produced, by simply sticking holes in paper, we pass to the line in sewing and drawing—to the transition from the line to the surface in weaving and interlacing of paper—to the surface itself in the squares of paper used in folding and cutting—to the outlines of solids in pea-work—to the surface boundaries of solids in the card-board modeling, and to the solid itself in the modeling in clay. Thus, by a different road, we have reached our original starting point, or rather, having made a kind of spiral ascent, we are now surveying the same truths from a higher plane. A vital point of connection between the gifts and the occupations lies in the fact that the latter offer the child the best possible means of embodying in visible and permanent form the impressions received through the former. Thus in pricking, sewing, and drawing, the children, when told to invent, almost invariably begin by reproducing the forms with which they have become familiar in their play with blocks and sticks. The same truth applies to their invention in mats, paper-folding, and paper-cutting; and an intelligent teacher can judge absolutely of the effect of her work by the free productions of her scholars.

Thus far, we have considered the kindergarten gifts and occupations simply from the standpoint of their effect upon the intellectual development of the child. They have, however, an additional significance in the fact that, taken together, they form a complete alphabet of work and exercise the hand in all the technical processes by which man converts raw material to his use. Ever since the days of Locke, thinkers and philanthropists have been trying to solve the problems of educating skilled laborers, and many have been the experiments of schools for the working classes, nearly all of which have failed, because built on a wrong foundation. The truth which Froebel plainly saw, was, that the schools should strive, not to turn out good shoemakers, bookbinders, or watchmakers—not, in fact, to teach any special trade—but to give such preparatory training and practice as would make all technical processes simple. Upon this basis he organized the kindergarten gifts and occupations, and, taken together, they represent every kind of technical activity, from the mere agglomerating of raw material to the delicate processes of plastic art.

Thus Froebel's gifts have a threefold purpose and a threefold application. Based upon the unchangeable facts of form and relations of number, they work powerfully in the direction of a healthy development of the mind, by their countless beautiful combinations of color and form the æsthetic nature is roused, and by the practical work they necessitate the senses are sharpened and the hand is trained. They appeal to the whole nature of the child, reaching at once his intellect, his emotions, and his physical activities, and contribute to produce a balanced development not attainable, I believe, by any other system. So much for the kindergarten material. A few words now as to the manner in which this material is used.

The practical basis of the kindergarten method is expressed in the formula "We learn through doing." It was a favorite saying of Froebel's that the world is sick with thinking, and can only be cured by acting; and accordingly, in the kindergarten free activity is the essential thing. The children roll and throw their balls, build with their blocks and lay figures with their sticks; they fold, they sew, they weave, they model, and gradually the labor of the hand clears the thought of the mind, and by using objects as material for work, their properties and powers are learned. In this lies the great difference between Pestalozzi and Froebel; for while the object lessons of the former appeal directly to the powers of observation the latter realized that children would never carefully and exhaustively observe any object with which they were not practically occupied. Children in the kindergarten observe, because they are constantly trying to reproduce, and their failure to attain satisfactory results causes them to notice objects more and more carefully. Another excellent result of Froebel's demand that the child shall learn through doing is, that it effectually prevents that rapid acquisition of superficial knowledge which is the bane of the present age. It is true that the path of learning should be made pleasant; it is not true that it should be made so smooth that it may be trodden without effort. He who struggles up no Hill Difficulty will never reach the Palace Beautiful, and the plan of constantly removing obstacles, instead of encouraging pupils to surmount them, both enfeebles character and destroys the vitality of the mind.

In the kindergarten the children work for what they get, but the steps by which they advance are so gradual, that whenever they make a faithful effort they attain some result. Consequently, they gain faith in their own ability to surmount obstacles, and develop in mind and will at the same time that they are constantly adding to their little store of ideas and experiences. Again, what they know they must know thoroughly, for the mind can only use and apply what it has perfectly assimilated, and the salient feature of Froebel's method is, that it transforms every element of knowledge into an element of creation.

If the practical basis of the kindergarten is expressed in the formula "we learn through doing," its intellectual basis is stated with equal definiteness in Froebel's so-called Doctrine of Opposites. No feature of Froebel's method is so difficult to explain as this, and yet it is the living link which connects the different parts of the system into a complete whole, and, as applied practically in the kindergarten, is as simple in its nature as it is fruitful in its results. It is based upon the logical law of the identity of contraries, a law which many philosophers have recognized as the necessary condition of thought. We cannot conceive anything without implying its opposite. We cannot think *up* without implying *down*. We cannot think of *light* without implying *darkness*. We cannot realize *extension* without assuming *limitation*. "In all distinction," as has been well said, "the element effective of distinction works through negation, and, therefore, affirmation and negation, identity and difference, must be taken together as constituting between them but a single truth."

Froebel claims, that as our thought is conditioned by this law, education should recognize and apply it, and he embodies it in the statement that "the principle of all creative activity is the reconciliation of opposites by an intermediate partaking of the nature of each of the extremes." This law governs the application of every kindergarten gift and occupation, and while its philosophic basis can only be mastered by earnest

thought, it is practically so simple that the child four years old uses it with the greatest ease and happiest results. The countersigns of the true kindergarten are, "Reverse, and keep your opposites alike," and I feel sure that any person who will honestly observe the effect of this principle in the development of originality and creativeness, will admit that Froebel has found the true law of human activity, and has shown how it should be applied.

A system based upon the necessities of the child, must naturally provide for physical exercise and development. Accordingly, in the kindergarten gymnastic games, accompanied with song, are an essential feature of each day's programme. In these games the children get abundant opportunity for using their legs and arms, while the fact that nearly all of them are more or less dramatic, makes them also developing to the imagination and sympathies.

From the moral standpoint, the chief significance of Froebel's method is the recognition of the child, both as a distinct individual and as members of a collective organism. The great problem for man has always been to harmonize the freedom of the one with the interests of the many, and to secure the development of the individual without sacrificing the order and stability which are the safeguards of general society. In the kindergarten the children are associated together under the most favorable conditions, and while individuality is strongly developed, each child early learns that his rights are limited by the rights of others. The only punishment inflicted is isolation of the selfish, willful, or quarrelsome child from the society of his companions; and on the other hand, where praise is given, it is given not by the teacher alone, but by teacher and children together. Thus the kindergarten is a world in embryo—a world where small virtues are nursed into strength by exercise; where small faults are gradually overcome, because their effects are clearly seen; and where character is harmoniously developed, because the same truths realized as law are felt as love.

The results of Froebel's system thus far have been partial and inadequate, because, in many cases, its principles have not been understood and applied. Its vitality and power are proved by the fact, that through all discouragements it has steadily won its way, and every day challenges more imperatively the attention of educators. Planted now in all parts of Germany, made by Imperial edict the basis of education in Austria, and introduced, though imperfectly, in Russia, France, Italy, England, and the United States, its merits will in the next few years be widely and thoroughly tested, and the general applicability of its methods determined. Its advocates ask only that it may be judged by its fruits, and, as their most conclusive argument, point to the children trained in accordance with its principles.

KINDERGARTEN TOYS, AND HOW TO USE THEM.

[A practical explanation of the first Six Gifts of Froebel's Kindergarten, by HEINRICH HOFFMANN, Pupil of FRIEDRICH FROEBEL.]

FIRST GIFT.

This consists of six worsted balls, in the colors of the rainbow, namely—three primary colors: red, blue, yellow—and three mixed: green, violet, orange.

Conversational Lessons.—On the round shape. Compare a ring, an egg, a pencil, thimble, saucer, spoon, etc. What other things can you think of that are round? Name things that are round like the ball, others that are like the pencil, the timble, the saucer, etc.

On Colors.—Name the six colors of the balls. Show something that is brown, black, white, etc. What things are green, red, blue—first, in nature; second, in art? What is understood by painting, dyeing, coloring, etc.? What is the use of signal-lamps?—of the colored lights used at night on horse-cars, etc. A word against colored sweetmeats may also be useful.

Manual Exercises with the Ball.—Holding it firm and safe. Resting the ball motionless in the open palm of the hand, even when arm and hand are gently moved sideways, or up and down. Or, whilst the ball rests in the two open hands, like in a basin, or nest, the children may sing or say:

The little { doll lies in } its bed,
{ ball lies in } my hands, so quiet and so still,
I'll gently rock it till it sleeps, and nurse it well, I will.

Rhythm and motion must be in strict accordance; and continuing in a subdued voice:

Hush! hush!
Hush! hush! let it sleep! gently sleep, hush! hush!

the child still swings gently his arms. Suddenly the ball moves, rolls about, in the open hands:

The ball is fond of moving;
It likes to be a-roving, moving, roving, moving, roving.

Then lowering one hand whilst the other is slightly raised, the child allows the ball to roll over the fingers, keeping exact time with the rhythm of the words.

Gradually the ball grows more independent of the close grasp of the fingers. It rolls over the fingers into the lower hand:

Dew-drops from the leaflets fall;
From my hands the little ball.

This rolling about of the ball in the open hands forms an excellent gymnastic exercise; the whole body of the child is in motion. The movement resembles the sifting of grain:

Sift the grain from dust and grit,
Pure must be the bread we eat.

Or, the ball passes from child to child, facing each other, first at short, then at greater distances; or rebounds from the wall, describing an arch in all its variations, from the slightly curved, almost horizontal line, through the oval, to the perpendicular. Nothing must escape the observant eyes of the children. Thus attention is drawn to the double motion of the ball, the progressive and the rotary, when it rises or falls:

In its rise and in its fall
Round and round spins our ball.

What is the cause of this rotation? The rolling over the fingers, when the ball leaves the hand; prove this by sending the ball up from the flat hand. To practice strict attention, as well as knowledge of the colors, let the balls be distributed according to the colors, so that the same color appears in regular distances; the teacher names things, which bear the one color, or the other; and at the word *green*, or *blue*, or, the mere description of the color, the *proper* balls rise in the air simultaneously.

Strict attention is further exercised by the following: The children sit face to face at the table, A opposite to B; C to D, etc. A rolls a ball across the table to C, C to E, E to G, whilst B sends a second ball to D, etc. More and more balls are gradually introduced, and the utmost quickness, vigilance, and attention are called into play. A few words sung to it, will materially assist in regulating every movement, and in preventing confusion:

Zig, zag, zig, zag, runs the little ball,
Tic, tac, tic, tac, it sounds from the wall.

Nor must the elasticity of the ball be overlooked.

The ball on the string forms another series of exercises. By means of a bodkin, one of the colored strings is attached to the ball. In swinging it to and fro, the child will compare it to the swinging of the pendulum of a clock:

To and fro, to and fro,
That my ball can nicely do;
Straight and steady must it go,
Not too fast, and not too slow;
Here and there, and front and back,
Sometimes *tic*, and sometimes *tac*.

Little clock, we want to know,
Is it time to school to go?
For sleeping, for rising, for dinner, for tea,
For working, for playing, a time there must be.
Sluggards always are too late,
Sluggishness all people hate.
Little clock, pray do go right,
Mark the hours in their flight.
Tic, tac, tic, tac.

Or it suggests the chiming of the bell:

Bell high from the steeple,
Calls to church the people.

This is imitated by the children with appropriate swinging of the body. When the string is held at the end, the swinging is slow, but when nearer to the ball, it increases in speed. Then follows the circular swinging, either in the air, or on the table, or floor. The latter will show a double motion, the progressive and the revolving. The six strings, each holding a ball, may also be twisted together, until they form one closely twisted string. Held at the extremity, they will unwind in a quick, rotary motion, and exhibit a beautiful play of colors. The two sticks may be inserted in the lid of the box, the perforated square piece of wood stuck across on the top of the sticks, thus forming a beam for swinging. Draw a string through one of the holes, and the ball will swing fast or slowly according to the length allowed.

SECOND GIFT.

This consists of a wooden ball, a cylinder, and a cube, with holes and eyelets in each; also some strings and a stick. Thorough acquaintance with the properties, peculiarities, and relations to each other, of the ball, the cylinder, and the cube, by a series of practical illustrations, is the main object of this collection. Now the soft colored ball, harmless to the child, and involving no danger to surrounding objects, is substituted by one which conveys to the child's mind more clearly the idea of smoothness, weight, hardness, and sound.

The following lessons and exercises throughout this treatise comprises the entire range of infant life, from babyhood to the age of six or seven. It must be left to the judgment of mothers and teachers to select, adapt, and alter, for each individual age and capacity, what they think best.

In order to fully understand any object, compare it with the opposite of its own kind; thus the ball and the cube are opposites, the minute comparison of which will illustrate the peculiar qualities of each, far better than the examination of one alone can. Between the two, the cylinder stands as medium, combining in itself the roundness of the ball, and the edges and surfaces of the cube. If we fancy the edges removed, the ball is reproduced; if the roundness be squared and leveled, the cube will be seen.

Draw comparison, first, between the soft and the wooden ball; second, between the ball and the cylinder. How can you place several cylinders on one another? Try to do the same with the balls. Roll the cylinder, roll the ball. What difference is there in their progressive motions? Can you roll the cylinder on the ends? Put the cylinder upright on a piece of paper—run a pencil round the edge—try the same with a ball. How can you pile ball, cylinder, and cube, on one another? Try it another way. Is there a third? Explain the use of the cylinder in the garden, the kitchen, the street, the mangle, in machinery in general; of the ball in its various materials and adaptations. How many surfaces has the ball, how many the cylinder?

Most of the games, as described in the First Gift, can be repeated with the wooden ball, only let it be understood that, for the purpose of

throwing, the soft ball only is to be used. An excellent exercise in developing a sense for rhythm and music, is afforded by the wooden ball. A child marks the fall of the long syllables, in the singing or reciting of verses, by gently knocking the ball against a hard substance. Whilst, for instance, the children drop the ball from one hand into the other, one child marks the time—

Dew-drops from the leaflets fall,
From my hand the little ball.

What can the ball do? It can lie quiet, can roll, fall, jump, swing, give a knock, rise, spin round, come and go; and, on a string, it can swing, dance about, describe a circle on the floor, whirl round, imitate the pendulum of a clock, show the perpendicular line, etc. In all these exercises, use as many rhymes as you can think of. They assist and exercise memory, give a livelier interest, and draw greater attention to the manipulations; they cultivate a taste for verse and musical rhythm. The following exercises need no further explanations:

Round the edge I run in a plate, right across when on a slate;
Move your hands, and bid me go; strict obedience will I show.
Let me rest, or run, or roll; make a bell of me to toll;
Let me swing, or dance, or fall; always I am yours, the ball.

Under all circumstances the ball is the same; not so the cylinder. Put a string through the brass eyelet in the edge, bring both ends together, twirl the double string well, by turning the cylinder round and round. When the string is firm, draw gently the ends apart, and unwind it. The cylinder will quickly revolve, and will show a totally different body. When the string is nearly unwound, join the ends quickly again, and the revolving force of the cylinder will retwirl it, so that this play may be continued for any length of time. The same experience will be made when the string is applied to either of the two remaining cyelets; so that the cylinder, in its rapid revolutions, will show three different forms, all more or less illustrating its relations to the ball.

The child is born a poet, and his little world is a paradise of poetry and imagination. He embodies in imagination, with life and beauty and graceful art, the simplest and rudest forms, just as some nations, like the ancient Egyptians and Persians, used to do in their infancy. The ball, or cube, or cylinder, on a string, will be to him a better representation of a cow, a dog, a sheep, and of a hundred other things, than the most elaborate wood carvings in a toy-store, because they are the creations of his own genius or imagination.

The form of the cylinder will call in mind many objects which resemble it: a pile of coins, a cucumber, a sausage, etc.

Examine the surfaces of the cube. Compare them with the surfaces of familiar objects in the room—the table, the door, the slate, the window-pane, etc. Notice the impression of the surfaces on the sense of touch—smooth, leveling; in opposition to that of the edges—sharp, cutting; and of the corners—pointed, piercing. What lines, and how many of each description border the surface? Illustrate the horizontal and the perpendicular line by numerous lines in the room. Explain and exemplify the right angle. Let the children find other lines in the room, in the corners of the window-panes, and elsewhere. Express their positions by words: at the top, to the right, left; at the bottom, to the right, left. Compare the surface of the cube with the curved one

of the cylinder. How many surfaces has the cube? Holding it up, let their places be defined by top, bottom, front, back, right, and left side. Compare it with the room, and point out the same six surfaces. Then expose to view one surface only; then two, by turning an edge; then three, by turning a corner towards them. Can you see more than three surfaces at once? How many edges and corners do you see when you see one, two, three surfaces? How many edges has the cube? How many of them are horizontal? How many corners are there? How many right angles? The cube will rest on any of the surfaces. Can you place it on an edge? Is it really impossible? Can it stand on a corner? The surfaces are called squares, because their sides are of equal length, and their angles of equal size. Explain the difference between corner and angle. When this is well understood, apply the stick to the perforated cube. First, put it through the hole, from corner to corner, and twirl it round between the fingers; second, through the hole from side to side, when the swift revolving will show the cylinder; and, third, through the hole from edge to edge, when the reverse form of the first will appear. The same object may be attained by applying a string to the brass eyelets. That many interesting and easy lessons in arithmetic can be added, needs no more than a mere hint.

THIRD GIFT.

One of the greatest blessings ever bestowed on mankind by the great Giver of all bounties, is the spirit of inquiry—that eager, restless thirst after knowledge which has been the first and principal agent of all human progress. Without it we should scarcely have raised ourselves above a mere animal existence. The same spirit that prompts men like Humboldt or Livingstone to hazard their invaluable lives in inconceivable dangers, animates every little child, and manifests itself in every action, in every idea of his play. A single cube, after being fully comprehended, will not satisfy him long. If he had a knife, and if the material of the cube would less resist him, he would certainly divide it into parts, to investigate the interior, and to have materials for new and further compositions. This natural tendency led Frœbel to select for the Third Gift a wooden cube, divided into eight equal parts, so that each part should represent the whole on a smaller scale. Thus we have in this gift or box eight cubes. The first thing the child will have to learn must be the proper mode of opening, emptying, refilling, and closing the box. The lid is opened about half an inch, the box reversed, bottom upwards, the lid fully withdrawn, and the box lifted off gently, when the eight cubes appear as they were in the box. The box should afterwards be placed over the cubes, which should be gradually drawn off the table on to the lid of the box; then the whole should be reversed, and the lid put on again. Careless throwing out of the box, anyhow, must not be permitted. That order is the soul of everything, let the child practically learn, and learn it early; he will soon experience that an irregular filling of the box will not give space to half the number of cubes—

Each cube must have its proper place,
Two cannot be where one finds space.

In order to cultivate harmoniously the three powers—intellect, feeling, and acting—the forms practiced with this, and all the following gifts, are threefold: First—mathematical; second—artistic; third—forms of general utility. We may call them the three H's—head, heart, hand. What we *know* to be mathematically and logically right and true; what we *feel* to be proper, harmonious, good, and noble; we must put into working shape, and must *apply* to life and life's hard labor with a steady will and with sound energy. It is the old familiar—thinking, feeling, doing.

First Series—MATHEMATICAL FORMS.—Compare the dissected cube with the solid cube of the Second Gift. Observe the cross cuttings on each side of this, whilst the other is one undivided whole. Two cubes above, and beside each other; two times two times two are eight. Divide the whole in two equal parts, first in the perpendicular, then in the horizontal direction. Whilst the children do this let them say: "A whole, two halves;" and joining them again: "Two halves, one whole." With more advanced pupils you may continue: "A half, two quarters; a whole, four quarters." It will be easy to illustrate, in a clear manner, addition, subtraction, and multiplication, up to the number eight. Word and action must, however, always go together. It is advisable to have the tables checkered with cross lines, so that the whole is divided into squares, exactly of the size of the cubes. The greatest accuracy and order in placing the cubes will thus be easily attainable. Place the cubes side by side in one long line—say what it represents. Then, counting them, take four off for a second line, representing a street; or place each one singly in two rows, as villas. Place two, one on the other, the upper cube covering the lower one perfectly—then let the top cube overhang the bottom one; how far can it project without dropping? Try to pile more cubes on one another, overhanging each other. Erect two straight pillars; and let the child try to lift one up, and put it down again without disarranging the cubes. Then try the same with one pile in each hand. The pile should, at first, be of two or three cubes only, and the number may be gradually increased. By degrees the child will acquire sufficient steadiness of nerve to carry any combination of cubes in his hands through the room, and to place the whole on the table in perfect safety.

To practice well the important art of expressing ideas in a concise and unmistakable manner, the teacher may propose the following games:

Teacher—I will take eight cubes, and will shut my eyes, and Charles shall tell me how to place each single cube.

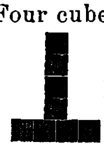
Charles—Four cubes side by side.

Teacher places them— 

Charles—No, teacher, close together.

Teacher—Well, then, now repeat: four cubes, close together, side by side 

Charles—Four cubes on the top in the middle.

Teacher—  Right, what does it resemble?

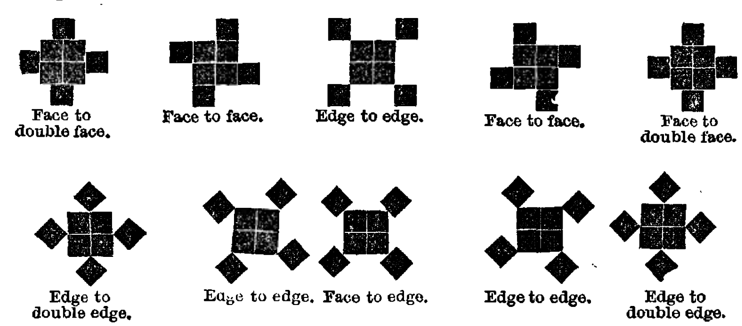
Charles—A candlestick. Another child says, a steamboat. Another says, a factory, with a high chimney.

As to exercises in arithmetic, care must be taken not to leave for the present the safe and firm ground of ocular demonstration; nor to attempt to exceed the limit of eight; and above all, to consider the age and the capacity of the children. There should be no mere lip-work and parrot routine. Whatever is taught, must be clearly and thoroughly understood.

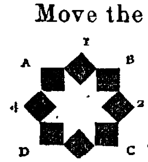
Second series of forms—ARTISTIC.—These forms are to cultivate the sense for the beautiful, the tasteful—the result of order, harmony, and symmetry. They train the eye to see quickly and distinctly, the feeling to reject all that is unsightly, to revolt against everything misshapen, inharmonious, untidy; and the hand quickly and steadily to improve, to rearrange, to rectify. The immense importance of such exercises, their incalculable bearing on the moral character, as well as on a happy, successful course of life, cannot require any special recommendation. By the cultivation of the outward eye, the inner perception and intelligence will become all the clearer; and these exercises will be an invaluable preliminary introduction to a study of art. An important principle in Froebel's system may be stated here. Accustom the child to develop figures and forms by slight changes and alterations, rather than to destroy each single one preparatory to constructing another. Proceed from one given form to a new one, naturally and logically. Herein, indeed, is more than first meets the eye. The child will learn to be strictly methodical in all his doings, as well as in his reasoning.

Now set the cubes before you, as they stand in the box.

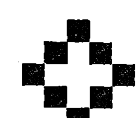
Place one of each of the four cubes of the upper half to the four sides of the lower, beginning at the middle of the sides, and proceeding to the right:

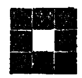


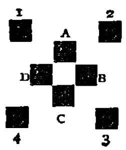
Move the inner square, so that the edges touch (*see next figure*).



Let A, B, C, D, be stationary, and 1, 2, 3, and 4 move round, as above, resting first at the surface, then at the edges, etc., but they must not lose their diamond form. Let nine children make each the open star, and join them, so that 1 touch 3 at the edge, and 4, 2. Three stars will thus be joined horizontally, and three perpendicular.

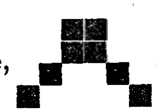
Proceed by putting the diamonds straight. 

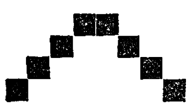
Develop in the same way as above, moving the extreme cubes. Push the outer or extreme cubes between the stationary ones, so as to form a square with an open center. 



Push the corner cubes out, join the left hand edge of 2 to the top edge of B, three to C, 4 to D, 1 to A, and continue the rotary movement as above.

Then place 1, 2, 3, 4 (diamond form), at the corners of A, B, C, D; remove the latter from the center, so that all touch at the edges, and an octagon appears. Any of these forms will serve as part of a whole pattern, when repeated and composed in the way described above.

The following is also interesting and instructive. Make one oblong, four cubes high, and two deep or wide. Whatever alterations are made, should be effected with both hands on each of the two columns simultaneously.  For instance, take two from the top, and place them edge to edge at the bottom. Once  more the same,  and once more.

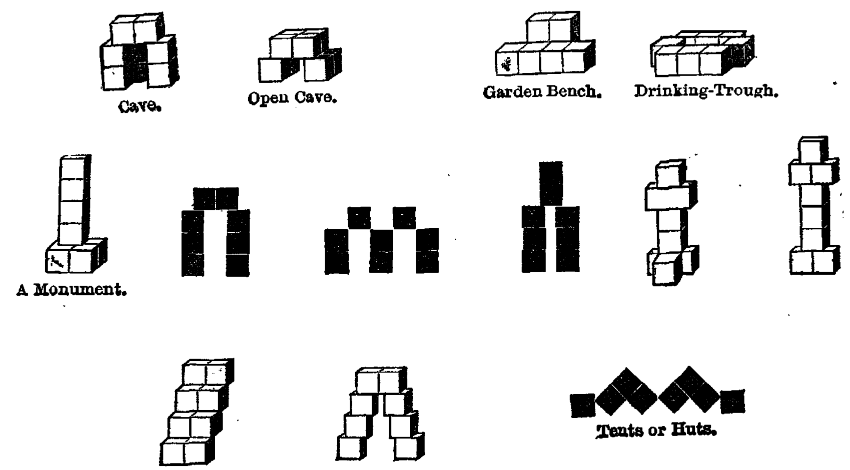


Take the two bottom ones and place them, diamond shape, on the top, and so on. Thousands of variations may be made, all thoroughly symmetrical. Thus children learn to hear, to think, to act, correctly and quickly.

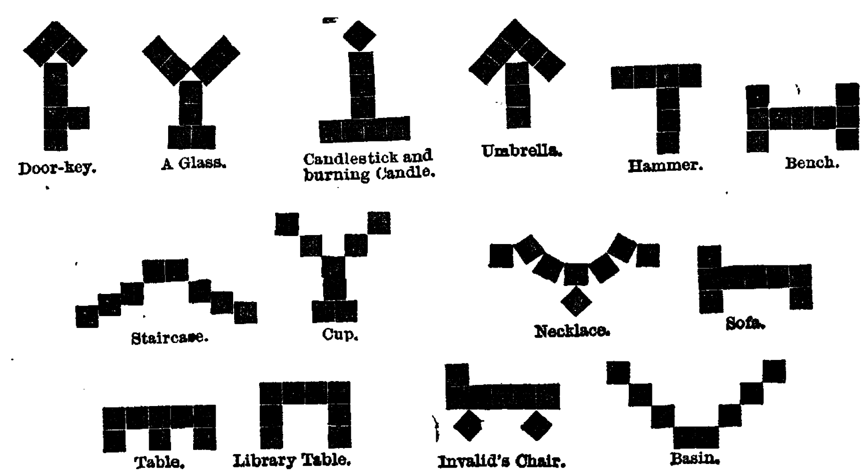
Third series: FORMS OF UTILITY.—Even the perfect harmony between head and heart will prove unsatisfactory without the signal glory of practical results—of fruits that enrich the industrial world with the happy realization of ideal dreams. Our third series of forms leads the child from the realms of mind and of artistic idealism, to the matter of fact necessities of every-day life. He now becomes architect, mason, carpenter, shipwright, and whatever his imagination will make him, by means of the simple material. Begin with the simplest form, and proceed, developing, altering, step by step, one form into another, without destroying. The child will soon understand that accuracy, neatness, and exact fitness, are indispensable to success. It would be absurd to dictate one unchangeable series of forms—the greatest freedom of choice is granted, so long as the important principle of developing, instead of isolating, is observed. The younger the children are, the greater will be their tendency to pile up. So one may at once proceed to the column, repeating the word "up," as the child adds another cube. Then taking them off, one by one, say: "down and up," placing this time the second in diamond shape on the first, the third facing him again, the fourth in diamond form, and so on. A round tower will be seen. The next form may be the zigzag tower, whilst another child

 makes the second cube overhang the first to the left, and when both are finished, they may be gently joined, so as  to form one building. A few simple illustrations will assist the teacher better than a verbal description can. The teacher will know how to bring each in its proper place, as well as how to assist the children in giving to each form its proper name.

UPRIGHT FORMS.



FLAT FORMS.



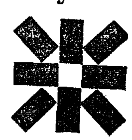
The letters **A E F H I K L N T** and others.

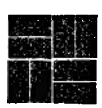
FOURTH GIFT.

While the cubes present no difficulty even to the youngest child, being of the same size and shape in all their faces, edges, and corners, this gift shows a marked difference in the proportions of the blocks which the box contains. We have here eight blocks, in their total of exactly the same bulk as the eight cubes. Two of these blocks can be united so as to equal exactly in size and shape two of the cubes placed side by side; only the division is different. There are two long and broad, two long and narrow, and two short and narrow surfaces to each block. Let the children well comprehend the relation of this gift to the third; then proceed to the *mathematical* forms. If we call the broad surface *a*, the long and narrow *b*, and the but-end *c*, we shall be able to give simpler and plainer directions. Two blocks lying side by side on surface *a*, are equal in breadth to the length of each block. Four blocks, lying on surface *b*, are equal in breadth to the length of each. Two blocks, lying one above the other on *a*, are equal to the height of one lying on *b*. Four blocks, side by side, resting on *b*, with their broad sides toward you, are equal to four with *c* toward you; and four standing side by side on *c*, are equal in height and width to four lying on *a*, one above the other. The nature and properties of the materials must be thoroughly understood before we study their use.

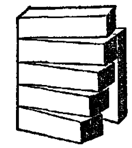
How many squares can you make with the blocks lying on *a?* How many when they lie on *b*, or on *c?* How many triangles can you describe with eight blocks? How many of the same kind? See what different kinds of triangles you can find. (This, of course, for more advanced children, who may also be able to describe a pentagon, hexagon, and octagon; but, as a rule, this may be considered the proper province of the Sixth Gift.) Without going deeply into grammar, the adjectives may be noted also, as high, long, short, thick, broad, narrow, wide, etc.; and may be practically illustrated. Many useful and interesting lessons in forms and numbers may be added, especially in combination with the Third Gift.

For the second series—the *artistic forms*—this gift offers many new and interesting features. The same course, as indicated with the cubes, may be adopted, and, moreover, varied, by placing the blocks on *a*, *b*, or *c*. Thus the star allows of three variations. The starting form, from which figures may be developed by the gradual movements and alterations, as described



in the Third Gift, is thus 

But, with the greatest delight, children hail this gift in building objects of every-day life. They make an interesting discovery when they place their blocks in a line on *c*, facing *b*, about one cube's distance one from another. A line of soldiers! A slight touch of the first or eighth, so that it falls on its neighbor, and the whole line falls, one after another. What a rich field for imagination! What a variety of forms this box admits of! Sofas, benches, tables, stairs, houses, windows, etc.



Of stairs, the geometrical or winding staircase is very pretty. Place one block on *a*, the second overhangs it slightly, covering all but a narrow triangular strip; the third the same, but all touch in one corner; the fifth is supported by one block, standing on *c*; and the others will be secure and firm enough, provided they do not much overhang.

Bedstead, Child, and *Nurse* also give much pleasure: one block on *a* is bordered on all sides by four on *b;* partly resting on the edge of the top-board, as on a pillow, partly in the *bedstead;* a sixth block on *a* represents the child; the seventh is placed on it as a blanket, leaving the head free; and by the side stands another as the nurse.

See my bedstead, strong and deep,
Baby now will go to sleep;
Nurse watches with loving eye,
Sings a pretty lullaby.
Delightful is the bed at night,
When one has done what's good and right.

A Seat, with footstool.—Two blocks *a*, one on the other, three blocks *c* standing behind them; and in right-angles to these, to the right and left side, two others; the last *a* serving as footstool.

A Throne.—Two flat, on one another; *upon* them, right and left, one standing; two others, right and left, stand against the but-ends of the seat; in the middle of the back two blocks stand, on one another, on *c*, to form a high back.

Garden-house, with open doors.—Two blocks *c* stand in the back; two others, right and left, at right angles; two lie flat on the top; two stand like doors ajar at either side.

A Table.—Form a square of two blocks *a;* in the middle of it place another of two blocks *c;* on the top of these place two squares, one on the other on *a*, with their joints crossing:  

A Mining Shaft.—Within a square, circumscribed by four blocks *b*, place another standing on *c*, and joined in the same manner.

A deep Shaft.—On the top of the one just described as standing within the square, place another block, exactly the same, care being taken that the joints do not coincide.

Two Windows.—To both ends of one block *a*, place another on *c*, and a third *c* on its middle; across each end-post put one on *a*, touching the center pole; on the top of all, two blocks *a*, joining at *c*.

FIFTH GIFT.

This gift is an extension of the third. We enter now upon a field of study and amusement which the kindergarten cannot exhaust, and which will yield a rich harvest of instruction and pleasure throughout the whole period of school life. We noticed in the Second Gift the principle of unity in the cube; in the third and fourth, the progressive development in the number two. Here "three" is the first thing that strikes us. Three cubes in every direction, added together, produce

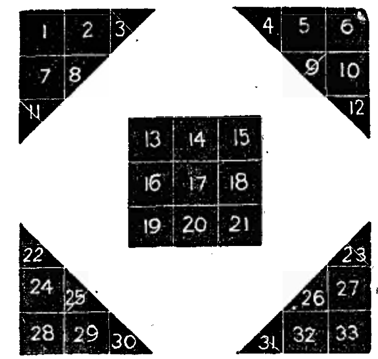
the number 27. This, in fact, is the first cubic number after the number 8. But the novel feature in this gift is not so much the number of cubes as the difference between some of them. We find 21 solid cubes, 3 dissected in halves, and 3 in quarters, making in all 39 pieces.

Form and number constitute again a large field of study in the *mathematical* forms. Before using the whole, we must consider the single parts, especially the new ones. One cube is cut in two halves, what are they called? 1st. Count their surfaces, edges, and corners, observe the angles. 2d. How many different forms can you make by joining the two halves? 3d. Compare one half with two quarters, and with the single quarters. 4th. Make one whole of four halves, viz: a square. Compare a square with a cube. 5th. Make other forms of four halves. 6th. What can you make of six halves? In the same manner proceed with the quarter cube, counting and naming all its various parts; then find five different forms of arrangement of two quarters, all standing on the narrowest edge, besides other forms in other positions. Then continue these exercises with 3, 4, 5 to 12 quarters. Form different squares by combining solid with dissected cubes. At the proper age, children will not find it difficult to copy these forms on a slate, or in a checkered book, an exercise which is recommended as highly important. Cubic blocks of cork, cut in pieces, in miniature imitation of our dissected cube (older children may cut them themselves), and gummed on card-board, will form an interesting collection of all the forms designed. With the more advanced, modeling-clay will serve this purpose still better. After the dissected cubes have been thus fully studied and comprehended, we proceed to the contents of the box, as a whole:

1. Divide the whole into three equal squares, standing and lying.
2. Into 3 equal lengths.
3. Into 9 parts, lying.
4. Into 27 parts.
5. Divide the whole into 2 equal parts, each forming an oblong hexagon.
6. Divide the whole into 3 parts, each forming an oblong pentagon.
7. Divide the whole into 3 parts, each representing an oblong pentagon.
8. Again into 3 parts, representing a hexagon, with 2 right angles.
9. Another division, a pentagon, with 3 obtuse, 1 right, 1 acute angle.
10. Another into 3 parts, forming a hexagon, with 2 right angles.
11. Divide into 4 parts, each a hexagon, with 2 right and 4 obtuse angles.
12. Divide into 6 parts, each a regular oblong hexagon.
13. Divide into 6 parts, each four-sided, with 2 right angles.
14. Divide into 6 parts, each an octagon, with 4 right angles.
15. Divide into 9 parts, each a hexagon, with 6 right angles.
16. Divide into 12 parts, each a pentagon, with 3 right angles.
17. Make an oblong hexagon of the whole, 2 cubes high.
18. Make an octagon of the whole, 2 cubes high.
19. Make a pentagon of the whole, 3 cubes high, with 3 right angles.
20. Make a pentagon of the whole, 3 cubes high, with 1 right angle.

The intelligent teacher will scarcely need any more hints for inventing many similar combinations.

We now proceed to the *artistic* forms.



Arrange the contents of the box as above. The center may also stand in diamond form. Any of the cubes may be changed in its position, except the center, No. 17, which remains immovable; but, whatever is done, must be done with the three corresponding cubes also. When, for instance, No. 15 is placed cornerwise, so as to form an open triangle, Nos. 21, 19, 13, must be in a similar position.

Change No. 2. Pull out 2, 10, 32, 24, to leave an open square.
" " 3. The same with 5, 27, 29, 7.
" " 4. Place cornerwise 1, 6, 33, 28.
" " 5. Pull out, edge to edge, 14, 18, 20, 16.
" " 7. Join 8 to 14, 9 to 18, 26 to 20, 25 to 16.
" " 8. Move 8 to the center between 3 and 4, and the corresponding pieces in like manner.
" " 9. Let 14 touch 8, diamond-shape, and the rest to correspond.

And so on, according to fancy. The variety is endless. The kaleidoscopic effect of many of these simple forms is surprising.

The teacher may now be left to her own taste and discretion. Enough has been done to illustrate the system; and it must not, by any means, be understood that the above changes are the only ones to be adopted. The same road need not once be traveled over again.

The forms of *utility* of the Fifth Gift are almost inexhaustible, and children may, at this stage, be well left to their own inventions. We will describe an example of such forms here.

A large Park Gate.—Seven pillars, three cubes high, at one cube's distance, should be arranged in one line. As a guide, a quarter cube may be temporarily placed between each, with its right angle upwards. Cover the middle pillars with a quarter cube, the others with half cubes; place small square pillars, formed of two quarter pieces, at each end; cover these with one quarter, as a roof; in front of the middle, place a pillar formed of four quarter cubes, covered by one quarter. A great many variations and alterations may be made from the design above described.

It should be borne in mind that all the pieces must be employed in every structure or composition. This is an important rule, which must be followed, not with this gift only, but with all the others.

SIXTH GIFT.

In the same way as the Fifth Gift was a development of the third, this gift is developed from the fourth. We find in it the same bulk which characterized the fifth, but the shapes of the pieces of wood differ, consisting in this instance of 18 blocks, together with 3 cut lengthways and 6 cut across, so that we have 6 pillars and 12 square tablets; in all 36 pieces. The same rules as in the foregoing must guide us here. We must first study the relations of the new parts to one another and to the solid blocks. Compare the tablets with the whole pieces and with the cubes. What relation do they bear to the cube? Is there any difference in the number or the nature of their surfaces, edges, corners, and angles? Compare them with the pillars, the pillars with the cube and with the whole blocks, the tablets with the half and quarter cubes. Form triangles with the tablets, and also with the pillars and whole blocks. How many different triangles can you form with the one and the other? Then proceed to form open squares, pentagons, hexagons, etc., up to twelve-sided figures. Compare each with similar figures constructed from other pieces—one formed of cubes, one of pillars and of blocks. Let squares of different sizes be formed, as also other rectangular forms. If the teacher succeed in combining *artistic* and tasteful designs with *geometrical* forms, and thus finding transitional forms, leading from one series to another, additional interest will be secured. Although the artistic forms of this gift cannot be produced equal in beauty to those of the Fifth Gift, yet to a tasteful and ingenious mind even these materials offer a vast field of invention. It is essential to have a good starting form. Pretty figures can be developed from the equilateral triangle, especially when the pieces are judiciously arranged. But if the Sixth Gift is not so well adapted to decorative forms, it surpasses the previous gifts in adaptability to architectural and industrial forms. Without copious illustration by diagrams, it is difficult to describe fully the rich field which an inventive and ingenious mind will delight in developing. Many forms of the Fourth Gift may be taken as a basis for larger and more complicated compositions.

Park Gates.—Six blocks in one length. On the middle of each block a tablet, on each tablet a pillar, and on each pillar another tablet. The whole covered up with rows of blocks, each shorter than the lower one.

A Colonnade.—Two parallel rows, of three pillars each, which rest on three blocks. Tablets above and beneath the pillars. The whole covered by blocks.

Having become well acquainted with the first Six Gifts of the Kindergarten System, children will be fitted to proceed to the more advanced Kindergarten Amusements; beginning with the Alphabet and Stick-laying boxes, and gradually progressing to the artistic pursuits of Drawing and Modeling.

THE NERVOUS SYSTEM, AS AFFECTED BY SCHOOL LIFE.

By Dr. D. F. LINCOLN, of Boston.

You will not fail to be struck with the fact which meets us at the very outset of our inquiry, that an intimate connection subsists between this subject and many others standing upon the list which has been drawn up to represent "School Hygiene."

This connection, however, furnishes no obstacle to the execution of our plans of simultaneous joint authorship. Only one of the thirteen covers ground belonging, in a strict sense, to the present investigation. That subject is the one alluded to under the title: "Organs of the Pelvic Cavity"—a title designated to include all those derangements of health, about which so much has lately been written, occurring in young girls during the process of sexual development. About this matter I shall say very little, both because of my own want of special fitness for the task, and because it seemed to the department that the time had not yet come when a judicially impartial account could be given of this subject, which of late has aroused such bitter and general controversy. Perhaps in a year or two this may yet be done, but we have as yet made no attempt whatever to examine into the matter.

The next difficulty, however, is one of far greater moment, and I may state it as follows:

Our entire nation is believed to be suffering from certain widespread sources of nervous degeneracy. Our children are but a part of the nation, and must suffer along with the older members of the population. How shall we discriminate between what is national, and what is simply scholastic? Give the child a constitution derived from excitable parents; a nutrition in infancy and childhood from which iron, lime, and the phosphates are mainly excluded; a diet in later childhood, most abundant but most unwholesome, and based upon a national disregard of the true principles of cookery; a set of teeth which early fail to do their duty; a climate which, at its best, is extremely trying—killing either the aged by excessive cold, or the little children by tropical heat; an atmosphere so deprived of moisture that the most casual observers speak of it, and men of science consider it as capable of modifying our constitutions most profoundly; add to these influences, those of a moral nature, arising from the democratic constitution of our society, spurring on every man, woman, and child to indulgence in personal ambition, the desire to rise in society, to grow rich, to get office, to get everything under the heavens; add a set of social habits, as applied to young girls and boys, which is utterly atrocious, which robs so many of them of their childhood at the age of ten or twelve and converts them to simpering self-conscious flirts and men of the world, *ruses*, and independent of control, a depraved and pitiable breed of "little women and little men;" add finally the fact that we have now a population of six million, dwelling

in cities of over one hundred thousand inhabitants, and exposed to those deteriorating influences which notoriously belong to great cities; give the child these conditions to grow up under, and can you wonder that he or she "deviates from the type" (as it is fashionable to say) of the sturdy Anglo-Saxon pioneer who settled this continent? And can we wonder that educators, persons deeply interested in their profession and sincerely conscientious, should protest against the charges brought by physicians against their systems of instruction, should protest against the very title of this paper, and should appeal from the laziness and folly of parents, and what they consider as the professional prejudices of medical men?

With these difficulties, inherent in the subject, you will pardon me if I succeed in doing no more than positing the question. I nevertheless think that I shall show that schools do cause a certain amount of injury of the sort called "nervous;" but you must not look for anything like a statistical exhibit of the *amount* of harm done. The method of investigation which results in good statistics has been cultivated in precisely this direction in several cities within the past year, as in Philadelphia, St. Louis, New York, and elsewhere; but the opportunities and the working power of a single man are but very small as compared with the amount that ought to be done even in a single city. The present paper, therefore, aims, first, to exhibit the physiological laws which govern the subject, and to show how school life is capable on the one hand of benefiting, and on the other hand of injuring the fabric called the Nervous System; and, secondly, to illustrate these principles by citations from the opinions and observations of about seventy persons, physicians and teachers, who have favored me with correspondence.

[The citations were too bulky to read, and their publication is reserved until the paper is printed in the journal of the association.—D. F. L.]

In the most general terms, the nervous system may be characterized as an accumulator, a distributor, and a regulator of the forces of our animal economy.

By it the mind is informed of what may be seen, heard, felt, or touched; by it the perception is stored up, the thought remembered, the process of thinking carried on. By means of it, the beating of the heart and the circulation of blood through the body are regulated. If there is a demand for fresh blood, in order to sustain the activity of the brain, a portion of the nervous system is charged with seeing to it that fresh blood in greater quantities is sent to the brain. By means of nervous action the tears flow, the mouth is moistened when we eat, the stomach is enabled to digest its food, and the bowels to carry on what the stomach begins. And by it, also, the muscles are enabled to act and to transform the chemical force into the forces of motion and heat. In fact, the muscular functions are, in a sense, nervous functions. Not only that nervous force is consumed in the performance of muscular acts, and is reciprocally strengthened by such performance, but also that the muscles themselves seem, in the ultimate analysis, to be simply a spreading out of nerve tubes, as the foliage of a tree is the expansion of its boughs and branches. Hence, when speaking of the department of medicine called neurology, or the special treatment of nervous diseases, we are obliged to include the diseases of the muscles themselves under the same heading.

I have not begun to exhaust the statement of the functions with which the nervous system is connected, but will just call your attention to the fact that every one of these relations is double reciprocal, like the effect

of a pair of mirrors placed over against each other. Nothing happens to any organ which has not its effect upon some part of the nervous system, and nothing happens in our brains, or any other nervous organ, without producing its effect upon some organ not nervous. But it is not allowed to protract this statement as I might wish to do.

It is well to state here, in order to enable you to anticipate a little the results of this paper, that the actual derangement of the nervous functions, which are commonly believed to be produced by improper influences at school, are the following, viz:

First—A group collectively termed "Neurasthenia," composed of debility and general depression, dyspepsia, sleeplessness, irritability, headache; then nosebleed, a symptom of congestion, which seems quite rare in America as compared with some parts of Europe; then chorea or St. Vitus' Dance, a disease of childhood proper; then neuralgia, hysteria, irritable spine, or spinal anæmia, and menstrual anomalies.

This list was given in a printed circular of inquiry issued to physicians, and from their answers it appears that little remains to be added to the list. But I must add, that several correspondents have, of their own accord, suggested other evils of more or less importance—as insanity, self-abuse, injury to the urinary organs from long confinement, deformities of the chest and spine, and typhoid fever.

With this general view of the scope and tendency of our inquiry, let us now pass to the consideration of the first general division of the subject; the question, namely, "How many school influences directly benefit the nervous system?"

In the first place, the school may provide for a reasonable degree of physical exercise, which every scholar should perform unless excused by his physician. There is very little chance for healthy sports in great cities, and it is precisely in these cities the greatest number of hours is spent in schools. If civilization takes from its members the country air and country sports, which are the natural means of health, civilization is bound to make good the loss to those who are too poor to make it good for themselves; and that means nine tenths of the people in cities.

As regards fresh air, and other hygienic essentials of schools, the attempt is sometimes made to excuse deficiencies by saying "that the scholars are better off in school than in their own wretched houses."

This excuse is apt to prove fallacious. It is our duty to ask, when such remarks are made, "*How much* better off are they when in school?" Is the air at home charged with fourteen parts of impurity, for example, and that in school with only twelve or thirteen parts? Such a comparison reflects no credit upon the school; if both places are blamable, then our duty obviously begins at the school, which we build and furnish, and to which we compel the children to come.

But let us not delay over this sufficiently obvious point. What we desire to know just now is, whether a thoroughly good school is a positive benefit to physical health. Granting that the air is pure, and the surroundings are all hygienically perfect, are the work and the discipline of schools beneficial, *per se?*

And first, as to the work, the simple mental work; is that capable of doing positive good?

The answer to this question is as follows: Pure mental work, quite free from what is called "feeling," is not possible to a conscious human being; but pure work, accompanied by a simple feeling of satisfaction termed "interest," in a moderate degree, acts on the system like any

other healthy work, by consuming the chemical elements; if the brain is at work, one sort of change goes on; if the muscles, another sort; but brain work and muscle work equally create a demand for fresh nourishment, and this demand constitutes a healthy appetite for food. It is fully understood by "brain workers" that certain studies tax the endurance of the entire system as much as the severest bodily toil. Persons with good brains are fatigued by mental labor as much as persons with good muscles are by bodily labor. Now I do not mention fatigue as a desirable thing, but the processes which lead to fatigue are good if kept within reasonable bounds, and I hold it to be physiologically correct, that these processes are much alike, though not identical, in the acts of thinking and of muscular motion. Indeed, voluntary muscular motion is absolutely dependent upon a supply of nervous force, which is probably generated in a portion of the brain lying within the temples. When muscles are palsied, their nerves are pretty sure to be affected; and when nerves, their muscles; hence, it is often extremely difficult to say whether a given disease of either organ begins in nervous tissue or in muscular tissue.

Mental occupation, like all other natural occupation, is therefore good; or at least, it has a presumption in its favor. But the value of this work is vastly enhanced by the methodical way in which a good school enforces its performance. Our teachers, in many cases, deserve the greatest credit for their judicious firmness in restraining from overwork, as well as in requiring the full amount of work; and I know well that adult students would often be benefited by such regulations as would prevent them from over-driving their intellectual machine.

Why, then, can we not make our children work with their brains and trust nature to develop their muscles? I believe there is a special reason why we may not do this, and somewhat as follows: The nervous organs are not peculiar in requiring nutrition; they are dependent upon the blood, which conveys to them what is required to repair waste; and the blood is again dependent upon the heart and the blood-vessels, which pump it to the points of supply. Now, the heart and the blood-vessels are muscular organs; their capacity to force the nutritious fluid to its destination depends on the amount and the good condition of the muscular tissues they contain. A strong pulse is needed by a strong brain, and if we want a strong pulse we must strengthen the heart. And in no way can this be done except by muscular exercise, which drives the blood to the heart, distending and stimulating it in such manner that the organ gradually increases in size and firmness, growing vigorous in sympathy with the other muscles of the body. Of the danger of excess in this practice I will speak later.

Of the muscular structures of the chest there are some which have no particular use except to assist in breathing; these, the respiratory muscles, need a similar development through training, in order that pure air may be largely introduced into the lungs, a process which you know to be indispensable to the proper nutrition of the body, and the performance of the processes of oxydation required by all the tissues.

So far we have seen that muscular activity is indispensable, even to the health of the brain, while as regards the action of the brain in thinking, we have succeeded only in establishing a presumption in its favor. This being the case—the one being essential, the other permissible—it would seem as if those who exercised their muscles stood a better chance of perfect health than mere brain workers. It is commonly assumed that boys are necessarily in better health when let run

freely in the open air without schooling, and that day-laborers are the healthiest part of the community. But these assumptions are greatly neutralized by two facts; the privations undergone by the poor, and the noxious effects in any class or age of excessive muscular exertion, which is certainly capable of doing as much harm as over-work of the mind. Consumption, various forms of heart complaint, of palsy, of muscular disease, not to speak of the great enemy rheumatism, are the penalties of excessive muscular effort. Stupidity is another penalty, deserving serious mention.

The laboring classes have diseases, as many and as serious as those of the intellectual classes. Nay, more; it would seem from statistics that the latter are much *longer-lived* than the former, however it may be with their health. Clergymen, lawyers, physicians, merchants, scientists, and men of letters live very much longer than the classes that work with their muscles chiefly; the figures are given differently by different authorities, ranging from fifty-six years up to sixty-five as the average length of life in the former, while the average life of all persons who reach the adult age is about fifty years. In the upper and professional classes in England, statistics relating to nearly forty-eight thousand persons have recently been published by Charles Ansell, showing that the average annual mortality in one thousand of those under sixty years of age, was 10.46 as against an average of 17.65 for all classes in England and Wales.

These figures may be taken for what they are worth; I use them only to rebut the common arguments in favor of the necessarily superior health of mere hand-workers. But another turn is given to the argument by those who assume that the educated and the rich, though longer-lived, are more subject to chronic troubles, as dyspepsia, neuralgia, and gout. This view is most incorrect, I am sure, as regards the population of large cities. No one who has had experience in dispensaries can think that the poor have as good health as the well-to-do classes. The well-to-do are those whom nature has blest with tougher constitutions, greater powers of mental work and endurance; persons of higher endowments in every way than those possessed by the poor; hence, while they know better how to take care of their health, they possess also better means for doing so; theirs are the sunny streets, the wholesome quarters, while to the poor belongs the gift of large families, and a doubled or trebled rate of mortality in children. Hence, also, permit me to say, upon them rests the imperative duty of helping their weaker neighbors to obtain a reasonable share of health and intelligence. The problem is, however, complicated, and it is impossible to give full value to all the arguments in this place.

So far we have seen, from several points of view, that the presumption is in favor of the wholesomeness of mental work, as required in a well-governed school. One reason for this has already been given. It is good for the body, because it is bodily work; because as such it furthers the processes of chemical transmutations, and hastens the renewal of tissues; and because it is better for us to have this renewal; a fresh body, one composed of recent elements, being more vigorous in all its functions than a stale and rusty organism. This is the fact as it looks from a chemical point of view. But we scarcely need technical language in order to understand this. It can be stated in every-day phrases; and it will be instructive to make a restatement of this sort which I will now do.

Our life is largely made up of appetites or cravings of various sorts.

The most familiar of these are the craving for food and drink, for breath, for sleep, for air and sunlight. The presence of any one of these, in a healthy person, shows the existence of a chemical exigency or crisis, which requires the addition of some element—carbon, oxygen, nitrogen, fat, starch, animal fibre, salt, water, and so on—or the introduction of some force, as light, heat, or atmospheric electricity. If these desires are not gratified, the health suffers. Now there is another class of cravings, equally important, and equally imperious in their claims: I mean the various desires to *expend* animal or mental force; the longing to exert muscular energy, the desire to move about after having sat still for a long time; the entire range of our mental powers furnishes us with examples of a similar sort, as the gifts of speech, of laughter, of musical genius, of the power to observe, to paint, carve, or otherwise represent, the power to command other wills, the capacity for greatly loving other persons, for receiving or giving sympathy; all these must be exercised by those healthy human beings who possess them, under penalty of a loss of well-being.

Now it is evidently impossible to exercise all our faculties at once in such a way as to bring each to a state of the utmost development. It is the business of an educator to see, first, that the faculties essential to well-being are developed; the muscles of respiration, through singing, dancing, running, and childish athletic sports; the muscles of the will, by similar methods, and perhaps gymnastics; the intelligence, by school instruction of various sorts; but while doing this, he should bear in mind those traits of childhood which are most irrepressible, and should both guide them and be guided by them. Muscularity—or more rightly expressed, a liberal indulgence in muscular sports—is the craving of healthy boyhood; if denied, no amount of mental occupation will take its place; on the contrary, mental stimuli are most dangerous to a boy who is physically idle, and only tend to hasten those sexual crisis (so fatally ignored by many educators) which are sure to come, and to place a certain proportion in peril both of health and morals. I am speaking of a great evil, and one little understood; for which the remedies are to be found in a liberal stimulation of all the nobler parts of a boy's nature at once—his will, his courage, his fortitude, his honor, his sense of duty to God and man, his interest in some mental pursuit.

As respects girls, there is no doubt that they are capable of taking as keen enjoyment as boys in muscular exercises, though of a somewhat different nature.

That it would be for their good to strengthen their wills and their courage by such methods, no physician can doubt. But the obstacles to such development are very great, especially in cities, and in all places where fashion imposes a limit to the expansion of the lungs, and cuts off the indulgence in the pleasure of breathing.

I trust enough has been said to direct your attention to muscular training as a branch of education. But it would be a neglect of duty did I fail to add that the whole matter must be under control and regulation, and that forced and violent exercises in gymnasiums, or out of them, are capable of doing great harm. It is a great mistake to work the brain until it can do no more, and then, feeling fagged out, to take violent gymnastic exercises or a long walk. Mothers know that their little boys *can* make themselves sick by playing too hard; some children cannot play too hard, and some adults can be Hercules and Apollo in the same day; these are few. I would suggest, that a rule of the following sort be laid down for those who are old enough to follow it: "Never let the bodily exercise be so crowded into a corner by work that you cease to enjoy it, to relish it as a well person relishes food; but as to the amount of exercise you take, let that be governed by the appetite for it. And do not feel bound to make your biceps big, for the muscles which do not show, those lying between the ribs, under the shoulderblade, and the diaphragm, are more important, and are suitably developed by systematized breathing, by vigorous walking, and a little running or lifting, if you can bear it." Such advice is, on the whole, more judicious for adults, who have severe tasks of a mental nature, than would be the indiscriminate recommendation of gymnastics.

I come now to another set of causes, which ought favorably to influence the health of scholars. I refer to the fact, not much understood in a practical way, that *happiness* is of itself one of the surest sources of health, or in medical terms, that joy is the best tonic we possess. Pleasurable sensations are imparted by all efforts made willingly, if within our powers. The scholar has that source of pleasure constantly, if he is well managed. He is interested—and interest is the chief factor in happiness, while want of interest is a sort of hell on earth. He has the sense of mastering difficulties, of conquering his own weakness and ignorance. His cheerfulness is promoted by making his work brisk and vigorous, both in recitation and during study. He is conscious of success and of gain, and that without reference to the standard of his fellows, but by reference to himself. His self-control and habits of order are strengthened, which must indirectly prove beneficial to his health. And finally, he is conscious of having a friend and sympathizer in the person of his teacher; or if not there is serious fault to be found somewhere; either the teacher is deficient, or else the class is so numerous that it is impossible for him to know the characters of his pupils.

Now let us turn the picture and see the reverse. What *harm* is done through injudicious schooling?

In answer let me say, that if mental enjoyment does good to the system, the sensation of inadequacy to one's task is a source of acute suffering and injury. Pain felt in a nerve is a proof that the nerve is not duly nourished, or has been tired out by overwork; and in accordance with this fact we find that its proper function, that of distinguishing objects by means of touch, is weakened during an attack of neuralgia. In muscles, fatigue easily passes into pain, which may quite cripple one for a while, as when a person begins too violently with gymnastic exercises. But in the mind we feel the pain called depression of spirits, when required to discharge mental functions beyond our strength. The sensation is like that felt by insane patients, suffering from melancholia, to whom life is only a burden and suicide the only apparent duty. But it is rarely the case that such a condition occurs in young children. If overworked, their minds are apt also to be strongly interested, their feelings in a state of tension; their ambition acts as a spur, and does not let them know how tired they are; so that irritability rather than depression is characteristic of children suffering from school tasks. And be it said, that this state is most needlessly aggravated by a great many petty restrictions and points of discipline, which keep the child in a state of continual apprehension. He is perhaps marked for tardiness, and hence eats his meals in a state of trepidation least he come late to school; he is marked for each recitation; he is constantly inquiring how

he stands, and if he is ambitious, the consciousness of impending destiny is ever present to his mind. I speak not of such folly as giving a child a demerit for not coming to school five minutes before the hour appointed; or giving merits for the performance of tasks like sweeping down the stairs of the school house, or sharpening the other children's slate pencils! But we are called upon very strongly to condemn all points in the management of schools, which give rise to anxiety, apprehension, exaggerated feeling, in short of any sort, whether of joy or pain, in the minds of scholars.

But leaving this point and returning to the consideration of the effects of over-work. These effects are developed either by excess in quantity or by a monotonous strain of the faculties in one direction.

As to excess in quantity, a child is capable of doing a good deal of work, but it must be done under the conditions of perfect sanitary surroundings, and above all, of frequent rest. "The child's brain soon tires," says West, "and the arrangement so convenient to parents of morning lessons and afternoon play, works far less well for it than if the time were more equally divided between the two." The need of frequent recesses is admitted by all, but I find decided differences of opinion among teachers as to how frequent they should be. If a child of eight or nine years works half an hour, he may be perfectly refreshed by five minutes' rest and amusement, and ready to go to work again; but if he is kept at his tasks for four half-hours continuously, twenty minutes will not begin to suffice to bring him up to condition. A long unbroken session takes out of a young child more than he can make good by repair before the next session; and the total of these excesses of waste are subtracted from his total growth, stunting his body and mind together.

Deprivation of sleep is another factor in producing exhaustion. And let it be remarked that the worst things about "home lessons" is the danger that they will be studied late in the evening, and by the congested condition of the brain thus produced, prevent the child from falling into a sound refreshing sleep.

Deprivation of food often occurs. A child under twelve cannot usually go more than four hours without food; and privation of this sort, though willingly borne by the zealous scholar, makes itself felt at the next meal-time by an incapacity to relish or digest what is set before him. Schools should always make reasonable provision of time and place for the scholars' luncheons, and if there is a long session, parents ought to be expressly informed of this, and requested to furnish their children with something suitable. As for the regular meals, a parent is inexcusable who will permit a child to miss them, or to take them irregularly, or to lose its appetite for them, except in case of war, insurrection, or peril by sea.

There is a condition, not infrequent in the adult occupants of schools, in which a person seems to have used up all the surplus of vital force he possesses. There is no remedy for such cases but a protracted rest from all that can tax the powers.

The same condition may be observed in older children. But in the younger—say those under ten—the danger lies more in another direction. Educators, whether teachers or parents, are always liable to forget that the extreme volatility of a child cannot be conquered, but belongs to his nature; hence, his tasks are always liable to be too monotonous—more like what an adult would think suitable than what a child would really be best suited with. Now, the overstraining of a

faculty in any one direction is a most serious matter. If a clerk is kept too long at writing, the muscles which hold his pen grow weary; the weariness grows chronic; pain and constraint begin to be felt whenever he takes up his pen; one muscle gives out entirely and he tries to make its place good by adopting a new plan of holding his pen; but the new way has again to be given up, and the entire process of writing soon becomes insupportable; he may even be prevented from work by muscular spasms in the fingers. The remedy consists in three things: first, rest; second, treatment of the wearied muscles; and, thirdly, regular voluntary exercises of the other muscles—those which are little or not at all affected—of the hand and arm; in other words, the hand has to be drilled into a habit of distributing its forces among various functions. The amount of mental and physical energy which would carry a man easily through a day's work on a farm, may thus, if concentrated upon one set of muscular functions, set up a disease in the latter which will end in paralysis. Nor is this true of the hand alone. A whole class of these diseases exists, denominated by the Germans beschaftigungs-neurosen, or professional diseases; thus the shoemakers' cramp, the ballet-dancers' cramp, the "hammer-palsy" of sledge-hammer men, and the myalgia (muscular pains and debility) of sewing women.

We often hear a distinction made between "natural" and "unnatural" forms of bodily exercise; and the preference is instinctively given to the former by most people. Now the very best forms of natural exercise are those which develop a rhythmic sequence of effort and pause. Walking, dancing, and running never exercise the two halves of the body at the same time in the same way; the efforts may be constant, but they are relieved by alternations of right and left. In fencing, the old masters try to teach a similar balance. It is not in man's nature, when furnished with a pair of organs, right and left, to use both at once in an absolutely identical way. Standing in a military position is the most fatiguing thing possible. And if we turn to an organ like the eye, which is capable of severe labor of a more intellectual nature, we find that though both retinæ are used together, yet both take turns, at intervals, of resting, so that we actually, while looking intently at an object, do lose the sight of it, though unconsciously, for a second, upon the right, and presently for a second upon the left side, and so on. Riding presents an instance where a pair of muscles must be kept rather firmly and steadily stretched to clasp the saddle; but in riding the whole body of the man is subjected to the rhythm of another body, that of the horse, so that a multitude of unconscious movements are made in the most perfect rhythm back and forward, to right and left, by the trunk. I need not speak of the respiration, the beat of the heart, the natural movements of digestion. Worshipers in the true temple of Hygeia use for the most part an antiphonal service; and the antiphony of effort and pause, in mental operations, gives the most beautiful—as the Greeks would say the most musical, stimulus and expression to the mind.

We do not as yet realize how intellectual an organ a muscle is. Those of the face are called mimetic, or muscles for the expression of emotion, but every voluntary muscle in the body, when in action, expresses the energy of one of the most complicated intellectual processes, though one little thought of as such—that of volition. And I cannot refrain from tracing the analogy a step or two further, between the case of writers' palsy, and that of nervous excitability and exhaustion from severe tasks at school. The points of analogy are as follows:

The child's mental trouble shows itself by unreasonable behavior, fits of ill-temper, quite foreign to his proper disposition; and the man's muscular trouble is commonly associated with strange and purposeless jerkings of the muscles, equally foreign to purpose and reason.

And still further; if you observe a man trying to write, in this disorder, you will see that the anxiety of the effort makes him ten times worse—as if his hand were afflicted with stuttering—while you well know that the anxieties arising from emulation, contention for prizes and rank, the unceasing effort to hold the tongue, to sit straight, to reach a given goal at a given time, wear out a child vastly more than long, hard lessons.

I had thought to enlarge upon the latter point, but will rather leave it to my correspondents, from whom you shall presently hear expressions of opinion upon the matter.

Although the subject of diet is so essentially connected with education, yet I must at present refrain from entering into a statement of the principles which should direct its regulation. But upon one matter I feel specially called upon to speak. Modern Europe and America during the last hundred years, have entered upon a vast physiological experiment. This consists in the use of a new order of stimulants, as a part of the daily life of everybody, except very young children.

Whether, in the energetic and strongly vitalized population of the Western States, children are allowed the use of tea and coffee, I know not; but in New England it is extremely common among the poorer classes to allow these beverages in full strength, as an article of daily use, to children of five years old and upwards. Let me therefore explain my reasons for speaking of the latter custom, and (eventually) for condemning it.

Both coffee and tea act pretty much alike upon the system. In reasonable quantities they are capable of stimulating digestion, of relieving constipation, of counteracting in a remarkable manner the effects of severe cold, of relieving neuralgic headaches, of driving away the noxious sleep of opium and other drugs, and stimulating the mental faculties in an agreeable manner.

They seem to place the system in a condition in which more nervous force can be expended in a given time, so that the person can speak, think, walk, write, more vigorously and for a longer period. But while thus laying a larger stock of ammunition ready to our hand, they also increase the danger of spontaneous explosions. While increasing our capacity for perceiving and feeling, they also render us more excitable; the feelings, whether of joy or pain, or of sentimental emotion, come quicker and are more overpowering. If they stimulate to muscular action, and render it more facile, they also give rise (as you all know) to occasional twitchings and tremblings of the muscles, quite annoying, and indicative of absolute excess in the use of the remedy.

In this respect, and in some others, there is a decided analogy between the action of these medicines and that of *strychnia*, taken in minute doses. Animals poisoned with thein or caffein die in violent convulsions. But the parallel is by no means complete. Rather let us say that these beverages act as *mobilizers of force*. To use them is like putting a hair-trigger upon your rifle.

I have not attempted to draw a picture of the evils which they may give rise to, but will confine myself to the legitimate inference which follows the last statements. If they render the expenditure of the nervous force easier, in what tremendous danger may they not place the young and excitable minds of American children, eager to learn and to excel? If under their influence the teacher is enabled to sit up all night, attending to an excess of school-work, will not the scholar be driven, by the pleasureable impulse to labor and the conscious ease of action given through coffee or tea, to a degree of over-work which, less in amount, may be equally disproportioned to his powers? I speak both of boys and of girls; but the latter will inevitably suffer more than boys. In the "grave, measured, and exact language of truth and verity," as Trousseau, the greatest of French therapeutists phrases it, "those whose nervous systems are weak, suffer, when using coffee even in moderate quantities, from heat, anxiety, palpitation of the heart, sleeplessness; if they use it in excess, from headache, vertigo, tremor of the limbs, pusillanimity, eruptions on the face; it may give rise to, or increase the diseases of hysteria and hypochondria." What teacher of children does not recognize this picture?

I desire, therefore, to express my wish, that the time may soon come when coffee and tea shall be withheld entirely from children under sixteen or eighteen years of age—according to their development—except when it is expressly recommended by physicians. It is absolutely beyond a question that most children will develop a better physique without them. As for adults their habits are necessarily very different from those of children, and we need not here extend our remarks to them. And as beer and wine are scarcely used by children, I will also pass them by in silence.

There are three special faults in sanitary conditions which do harm to the nervous system of those in school-rooms. These are, the means employed in lighting evening schools, the undue heat of school-rooms, and the excessive dryness of their atmosphere, with other impurities.

Our nation is fond of burning a good deal of gas or mineral oil, and as a result, our rooms are apt to get overheated. One gas burner consumes as much oxygen in an hour as several persons, thus contaminating the air very rapidly and heating the upper strata very much. In burning, gas gives out impurities, very perceptible to the smell, chiefly composed of sulphurous acid gas. Besides which, the power of direct radiation of heat possessed by a cluster of burners is very great; so that the heads of persons in the rooms, enveloped in a cloud of hot deoxydized sulphureted vapor, are subjected to the effects of radiant heat, which are of an irritating nature, quite different from those of fixed heat. Of course headaches and utter exhaustion are the result.

It is the general custom, I am sure, in American school houses, to keep the thermometer at about seventy degrees Fahrenheit, provided the furnaces will deliver heat enough. Dr. Bowditch says: "In the sitting room (of the family) the heat should not be above seventy-two degrees Fahrenheit, nor below sixty-eight degrees; seventy degrees, the medium, is the best." Now, with all possible respect for such high scientific authority, I beg to demur to this standard, widely accepted though I know it to be; for young persons and children, if properly fed and clothed and dried, it appears to me that sixty-six or sixty-seven degrees is quite enough. In the only perfectly ventilated schools I now remember, the temperature was kept at this point, and no complaint of cold was made by the scholars. The effect of excessive dry heat of climate upon persons of our race is usually manifested in the production of "simple general debility, a weakening of the bodily functions, marked by a diminution of the assimilative and digestive powers, and resulting in the loss of weight, and anæmia or poverty of

the blood."[1] And there is good reason to suppose that a difference of four or five degrees constitutes an important difference in climate. In an equable Summer climate, a rise of the thermometer at noon to seventy-six degrees may be felt as an uncomfortable heat, while a fall to sixty-eight degrees will designate the day as "cool."

Neither heat, carbonic acid and oxide, sulphurous vapor, nor excessive dryness of the atmosphere are felt as evils by the majority of our people. But all of them are dangerous in a special sense to the nervous system. Recent experiments made by Dr. Falk, in Berlin, show that air deprived of moisture makes the breathing more rapid and less deep; it quickens the pulse, and slightly lowers the temperature of the body; and in a few instances it appears that a current of absolutely dry air, continued for several hours, produced epileptic attacks in guinea pigs exposed to it. Dryness of atmosphere certainly tends to make the human subject irritable and excitable.

A few people are the victims of untold misery when exposed to carbonic oxide fumes. I do not know what can be done absolutely to prevent the evil—unless we give up furnaces altogether.

I will now close this portion of my remarks with a brief summary of the most conspicuous results of the investigation.

First—School work, if performed in an unsuitable atmosphere, is peculiarly productive of nervous fatigue, irritability, and exhaustion.

Second—By "unsuitable" is chiefly meant "close" air, or air that is hot enough to flush the face, or cold enough to chill the feet; or that is "burnt," or infected with noxious fumes of sulphur or carbonic oxide.

Third—Very few schools are quite free from these faults.

Fourth—Anxiety and stress of mind dependent mostly upon needless formalities in discipline, or unwise appeals to ambition, are capable of doing vast harm. It is hard to say how much is actually done; but a strong sentiment against such injudicious methods is observed to be springing up in the minds of teachers.

Fifth—The amount of study required has not often been found so great as would harm scholars whose health is otherwise well cared for.

Sixth—Teachers who neglect exercise and the rules of health, seem to be almost certain to become sickly or to "break down."

Seventh—Gymnastics are peculiarly needed by girls in large cities, but with the present fashion of dress gymnastics are impracticable for larger girls.

Eighth—The health of girls at the period of the development of the menstrual function ought to be watched over with *unusual* care by persons possessed of tact, good judgment, and a personal knowledge of their characters.

Ninth—One of the greatest sources of harm is found in circumstances lying outside of school life. The social habits of many older children are inconsistent with good health and a good education.

It is proper, also, to add, in as exact form as the nature of the case admits, a summary account of the process pursued in the inquiry, Of my correspondents, thirty were physicians, and forty principals of public

(1) Assistant Surgeon P. F. Harvey, U. S. A.

and private schools, and Superintendents of Public Instruction in various places.

It seemed best, in collecting opinions, to address physicians in different terms from those used towards educators. The one class knows more about medical matters, and the other about the methods of teaching; and the two, in many ways, occupy different points of view. Therefore, two forms of circulars were used.

The replies to these have been classified under the following heads:

1. Regarding the fact of the existence of diseases caused by school work or surroundings.
2. Nature of the maladies.
3. Excessive amount of study, as a cause.
4. Faulty methods of teaching, as a cause.
5. Bad sanitary condition of school, as a cause.
6. Dissipation out of school, as a cause.
7. Health of teachers.

1. *Fact of Existence*—The question was put to physicians as follows: "Have you observed frequent injury (see below for definition) of a temporary or permanent sort resulting from the excessive or unsuitable work exacted from children and young people in school?"

This was answered affirmatively by twenty-two; negatively by four; "Yes, but not from school work proper," by four; and "Very rare with us," by one.

The corresponding question, put to teachers, read as follows: "Have you seen pupils suffering from headache, nosebleed, inability, languor, or other complaints, which you think caused by school life or school work?"

Answer: No, eight; rarely, eighteen; often, three; yes, twelve; total, forty-one.

By these the special remark was made, to wit: "Boys, rarely," two; "Girls no worse than boys," one; "Never bad for the vigorous and strong," one; "Yes, owing to bad food and lack of exercise," two; "Yes, owing to over-exertion in walking and gymnastics," two.

There is here a reasonable degree of agreement between medical opinion and that of professional educators (who for the sake of brevity shall be called "teachers,") as to the existence of an evil; but medical men seem to be more impressed with its frequency than teachers.

2. *Nature of the Maladies.*—That which may be called "Neurasthenia," characterized by the symptoms of debility and general depression, dyspepsia, sleeplessness, irritability, and headache, was mentioned by fourteen different physicians. Seven others gave a general assent to the entire list of disorders printed in the circular.

And of these twenty-one, several made special mention of the following diseases, viz:

Menstrual anómalies	7
Irritable spine	5
Hysteria, chorea, neuralgia, each	4
Nosebleed	3

The latter is a symptom pointing to congestion of the head, observed frequently among school children by Guillaume, in Neufchatel, and

Becker, in Dormstadt. In these American school children it would seem to be less frequent. Of the "teachers," only three referred to it at all, though specially asked, and those three denied that they had ever observed it.

The teachers' replies add nothing to the list.

3. *Excessiae Amount of Study as a Cause.*—As regards the actual amount of study required, it is stated by the teachers that the number of hours spent in school, inclusive of recitations, recess, and gymnastics, is reasonable in most cases; twenty-five or twenty-six hours a week, or even less in twenty-three cases; about thirty hours in ten cases; thirty-six in one; forty-five or fifty in one, and sixty in one. The two last are certainly very excessive, and this is admitted by the correspondents, who are principals of large academies in New England.

Study at home is not required in nine cases; for scholars over thirteen years of age, two or more hours a day are required in eight cases, and less than two hours in fifteen; for those between ten and thirteen, one or two hours in seven cases; for those under ten, an hour a day in two cases. The latter requisition is certainly improper. The amount of study was considered "suitable" by twenty-six teachers, while ten thought it too great in their own school or under their own observation.

4. *Faulty Methods of Teaching as a Cause.*—A good many teachers have remarks to make, pointing in this direction:

The method of teaching and the qualifications of teachers are spoken of in general terms as inferior by	6
Emulation is condemned by	8
Emulation is praised by	3
Emulation is said to be good for boys by	7

The following recommendations are made, each by one or two teachers:

To educate girls over fourteen, as far as possible, by themselves; to let young people over fifteen or sixteen study by themselves; to guard young children against the nervous excitement which arises from simple contact with a large number, even of the best scholars in a boarding school; to let each young lady student have a separate sleeping room; to inculcate religion as a motive for conduct; to give more frequent recesses; more play ground; a room in the school for dancing in recess time; occasional reduction of work, or sending home for a while; to lengthen the terms, or require more time for the course of study; to pass the scholar more slowly through the different grades; to abolish public exhibitions; to abandon the "high pressure" system; to give more prominence to the study of physiology; and finally, "a total revolution!"

In fact, very few teachers have failed to see at least one point where the management of schools (I do not say their own schools) is faulty. And physicians, in making their suggestions, have spoken particularly against those features of school life which tend to produce anxiety and worry, as competitions and public examinations.

5. *Bad Sanitary Conditions of Schools as a Cause.*—Of these, ventilation is the only one mentioned by teachers, who speak of it as bad, in various degrees, in twenty cases, and as good in two.

6. *Dissipation out of School as a Cause.*—Question to teachers: "Do school girls of fifteen and upwards spend much of their evenings in company or at public places of amusement? What kind of harm, and how much, do you think arises from this class of excitement as compared with school influences?" This class of excitement was said to do more harm than study, by twenty one (21); it was said by nine (9) to do no special harm—in many cases because prohibited by the school; and twelve (12) state that the habit is frequent in the place they write from.

7. *Health of Teachers.*—A question put in the circular addressed to teachers, was answered as follows:

Health of teachers generally good, or no worse than that of other classes	5
Might be good if they took fresh air, etc	2
Very unhealthy vocation if they do not obey the laws of health	2
Health generally poor	9
Not much better than that of sewing girls	1
They break unless we take great care of them	1
More liable to break down than pupils	5
One of the occupations that bring most strain upon the nervous system	1
Health sooner affected than in other occupations	1

STATE BOARD OF EXAMINATION.

STATE BOARD OF EXAMINATION.

QUESTIONS PREPARED FOR THE USE OF COUNTY AND CITY BOARDS OF EXAMINATION.

INSTRUCTIONS TO BOARDS OF EXAMINATION.

1. The scale of credits has been changed by the State Board of Education to the following:

Written Arithmetic	100
Mental Arithmetic	50
Written Grammar	100
Oral Grammar	25
Geography	50
History of the United States	50
Theory and Practice of Teaching	50
Algebra	50
Physiology	50
Natural Philosophy	50
Constitution of the United States and of California	25
School Law of California	25
Penmanship	25
Natural History	50
Composition	50
Reading	50
Orthography	100
Defining	50
Vocal Music	25
Industrial Drawing	25
Total	1,000

Boards will please change the backs of the certificates to make them correspond to the new scale of credits.

2. Applicants must be examined in the following order:

General Questions.	Penmanship.
Written Grammar.	Natural History.
Spelling.	Reading.
Arithmetic.	Vocal Music.
History of the United States.	Word Analysis.
Theory and Practice of Teaching.	Composition.
Mental Arithmetic.	Drawing.
Geography.	Constitution of the United States and of California.
Physiology.	School Law.
Algebra.	Oral Grammar.
Natural Philosophy.	

3. Frequent complaints are made that applicants are not allowed sufficient time in which to answer a set of questions. In written grammar, written arithmetic, and a few other papers, at least two hours ought to be allowed. On the other hand, all applicants must be required to begin the same paper at the same time, and to finish it within a specified time.

4. The State Board will hereafter reject all papers, coming from the same county, in which appears a striking parallelism in the manner of answering questions. Examiners are requested not to correct, but simply to mark the errors occurring in the answers Some examiners, after correcting the applicant's errors, have allowed full credits for such corrected answers. Whenever the State Board notices anything like this in a set of papers, no State Certificate will be granted.

5. Boards of Examination are requested to call the attention of applicants to the remarks prefaced to some of the papers. Heretofore applicants have very seldom paid any attention to the special requirements of a paper. For instance, in written arithmetic, applicants are instructed that "no credits are to be allowed unless the answer is correct and the work is given in full, and, when possible, such explanations as would be required of a teacher in instructing a class; a rule is not an explanation." This instruction has generally been disregarded. In future this will be a ground for the rejection of the paper.

6. A credit is to be deducted for every misspelled word; likewise, errors in composition and grammar must subject the applicant to a loss of credits. A great many papers heretofore submitted to the State Board, would disgrace, in regard to spelling, grammar, and composition, a twelve year-old scholar.

7. Insist upon having applicants follow the "Rules and Regulations." Require them to observe strictly and to the letter the instructions of the fourth and seventh rules.

8. Reject all applicants who are less than eighteen years of age.

9. Reject all applicants who fail to reach fifty credits in written arithmetic, or in grammar, or in spelling. Applicants reaching less than sixty credits in any one, or all of the studies just named, must receive only a third grade certificate, no matter what average percentage they may make.

10. All papers for State certificates *must* be forwarded within fifteen days of the close of the examination, otherwise they will be rejected.

GENERAL QUESTIONS.

1. Write your name in full; number in examination; age; nativity; place of residence.
2. Are you an applicant for a State Certificate, and if so, for what grade?
3. In what schools were you educated? How long did you attend each?
4. What certificates do you hold?
5. What references in respect to teaching?
6. What letters or references in respect to moral character?
7. In what places and in what kind of schools have you taught? How long in each? How many months or years in all?

RULES AND REGULATIONS.

1. No communication. Every paper must be finished at one sitting.
2. No use of books during examination.
3. Write your name on one of the cards given to you, for the examiner, and keep the other to enable you to remember your number in examination.
4. Write on only one side of each sheet of paper, number your pages, leave a margin, divide into paragraphs, and do not crowd your words. Paper is cheap; write in a large, legible hand, and thereby save the examiners much vexation of spirit, and yourself some extra credits. Number all answers to correspond with the questions and subdivisions of questions.
5. If you find a question that puzzles you, do not waste time in worrying over it, but pass over to the next, and return to it after you have answered the others
6. Do not hurry; do not worry; do not get excited and nervous, but quietly write all you know about the subject.
7. In arithmetic, separate every operation by ruled lines across the page or by a blank space. Make large figures, and do not mix up operations.
8. In grammar, use the briefest forms of parsing and analysis, and do not waste words on details. Any School Grammar, ancient or modern or antediluvian, will be recognized as authority.
9. Do not attempt to "cram" for the examination, for it will only confuse you.
10. After you have completed a paper, examine it carefully with reference to spelling, capitals, and punctuation. Any deficiencies in legibility of writing, correctness of spelling, punctuation, and capital letters, subjects the examinee to a deduction of credits.

[QUESTIONS FOR QUARTERLY EXAMINATION, SEPTEMBER, 1873.]

ARITHMETIC.

1. The shadow of a tree measures 84 feet. A staff 20 inches long

casts a shadow of 9 inches at the same time. What is the height of the tree?

2. Add $\frac{3}{8}$ of a mile, $\frac{1}{2}$ of a furlong, and $\frac{3}{16}$ of a rod.

3. A sold B a farm and gained 20 per cent. B sold it to C and gained 10 per cent. C sold it to D for $1,254 and lost 5 per cent. What did it cost A?

4. A received $210, which was $\frac{2}{3}$ of B's portion; and three times C's portion was $\frac{1}{2}$ the whole estate. What was the value of the estate?

5. Analytical explanation of 12 divided by .06.

6. Compound interest of $600 for 3 years and 4 months at 10 per cent.

7. Solve both by proportion and analysis. What will 11 lbs. 4 oz. of tea cost, if 3 lbs. 12 oz. cost $3 50?

8. A invested $10,000 in business, on which he lost 15 per cent. He then invested the remainder and gained 20 per cent. What per cent did he gain in the two investments?

9. What amount of stock can be bought for $4,841, allowing 3 per cent commission?

10. How much currency can be bought for $150 in gold when gold is at 115 per cent, and what is the value of greenbacks when gold has the above valuation?

MENTAL ARITHMETIC.

1. How many times is $2\frac{1}{2}$ contained in 20?
2. What is $3\frac{1}{2}$ of 35?
3. How many times 4 inches in 12 feet?
4. Cost of 40 eggs at the rate of 2 for 5 cents.
5. How many yards of carpet are needed for a room 11 feet by 12 feet?
6. Sum of $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$?
7. Difference of $\frac{1}{7}$ and $\frac{1}{8}$.
8. Interest of $700 for 4 months at 10 per cent per annum.
9. Bought cloth at $25; sold for $30; what per cent did I make?
10. If you answer 6 questions out of 10, what per cent do you get?

GRAMMAR.

1. Write a synopsis of the indicative mood of the verb lie (to recline), giving only those persons and numbers of each tense in which the verb changes its form to agree with the form of its subject.

2. Write (1) a simple sentence containing an adjective phrase and an adverbial phrase, (2) a complex sentence containing an adjective clause and an adverbial clause, (3) a compound sentence consisting of two simple members. Expand one of the phrases of your simple sentence into a clause, and contract your compound sentence into a simple sentence.

3. Correct all the errors in the following expressions:
   (*a*) Have either of your three brothers returned?
   (*b*) I wanted to have gone to Vienna last month, but I do not wish to now.
   (*c*) He said he done it like I done it, but I seen him to do it differently.

   (*d*) But if it climb, with your assisting hands,
   The Trojan walls, and in the city stands.
   (*e*) Severe the doom that length of days impose
   To stand sad witness of unnumbered woes.

4. "He scarce had finished when such murmur filled
Th' assembly, as when hollow rocks retain
The sound of blustering winds, which all night long
Had roused the sea."
   (*a*) What kind of a sentence is this?
   (*b*) Give the principal subject and the principal predicate of the sentence.
   (*c*) What kind of a clause is *when hollow rocks*, etc.? What does it limit?
   (*d*) Parse *scarce* and *had roused.*
   (*e*) Parse *as* and *night*.

5. How is the progressive form of a verb distinguished from the passive form? Give a synopsis of the verb *see* in the potential mode, passive voice, third person.

6. Why do nouns and pronouns change their forms? Illustrate and explain the principal changes which they undergo.

7. What double offices do relative pronouns and relative adverbs perform? Illustrate by examples. Decline the simple relative pronouns.

8. What kind of adjectives admit of comparison? How are they compared? Compare next, last, eldest, dead, and worst.

9. When should the subjunctive form of the verb be used in conditional clauses? Give rules for the correct use of *shall* and *will* when used to denote future time.

10. Construct a complex declarative sentence out of the following statements:
   (*a*) I have an indifferent opinion of the vulgar.
   (*b*) Some merit raises the shout of the vulgar.
   (*c*) I am ever led to suspect that merit.
   (*d*) This I own.

GEOGRAPHY.

1. Name 5 mountain ranges, 5 great cities, and 5 great rivers in Asia.
2. Name all the seas bordering on Europe.
3. Name the two largest rivers and two largest cities of Europe.
4. Bound the Empire of Germany, and name its three chief cities.
5. What is the chief seaport of China? Russia? British India? Austria?
6. What are the chief exports and imports of the United States?
7. Name the characteristic animals of each of the zones.
8. Name the principal animals and plants introduced into the New World from the Old World.
9. What causes produce ocean currents?
10. State the area, population, and exports of California.

HISTORY OF THE UNITED STATES.

1. Who were John Carver; John Endicott; John Winthrop; Peter Minnit; Father Hennipen?
2. Give an account of the conquest of Acadia.
3. Conditions of the first Treaty of Paris.
4. Where and when were the first outbreaks of the Revolution?
5. Who was Burgoyne? Name some one of his exploits.
6. Tell what you know of the French Alliance during the Revolution.
7. Name five signers of the Declaration of Independence.
8. Name five powers granted to Congress and three powers denied to the United States by the Constitution.
9. Give at least five facts indicative of the progress of the United States since her independence.
10. What caused the present National Debt? How has it been diminished? Can you give any estimate of its amount at the close of the war?

THEORY AND PRACTICE OF TEACHING.

1. Give the outline of a short moral lesson on "Untruthfulness."
2. Mention two methods of developing the expressive faculties.
3. What use would you make of a reading book in teaching grammar?
4. Name some of the errors to be avoided in conducting recitations.
5. Explain what is meant by the agreement of noun and verb.
6. Explain to a class the course of the trade winds.
7. Give an analysis of the operation of dividing 10 by $\frac{2}{3}$.
8. Name an important rule of spelling.
9. What is your plan of keeping pupils at work while in school?
10. What is the proper use of *memory* in the process of instruction?

ALGEBRA.

1. To subtract one quantity from another conceive the signs of the *former* to be changed, and proceed as in addition. Prove the correctness of this rule.
2. Prove $-x\times -x=+x^2$; and that $-x\times +x=-x^2$.
3. Prove that $x^0=1$.
4. Divide x^3 by $x+2a$.
5. Factor $4x^2-9a^2$.
6. Factor $a^2+2ab+b^2-2ac-2bc+c^2$.
7. Find two numbers differing by 6, and such that three times the less may exceed twice the greater by 7.
8. Given the sum of two numbers $=18$, and their product $=77$; to find them.
9. The sum of the side and diagonal of a square is 100 feet; what is the length of each?
10. $\frac{1}{x}+\frac{1}{y}=5$, and $\frac{5}{x}-\frac{3}{y}=1$; find x and y.

PHYSIOLOGY.

1. What is the office of the central organs of the nervous system in sensation and motion?
2. What cavities does the mucous tissue line? How is the secretion of the mucous effected? Its use?
3. Where are the bile and the fluid secreted by the pancreas mingled with the chyme? What is one of the offices they execute?
4. How do the four parts of the heart act without disturbance? Illustrate.
5. In what two ways does violent exercise injure the lungs when the chest cannot be well expanded?
6. Of what bones is the dome of the cranium made up? Describe the different ways in which strength is secured around the base of this dome.
7. Describe the arrangement of the radius and ulna, and the manner in which such free and varied motion is given to the arm.
8. Describe the various parts of the vocal tube, that have an agency in articulation.
9. What is the object of the external ear? What is the use of its ridges and prominences?
10. How many coats has the eye? Describe the arrangement of the parts of the eye.

NATURAL PHILOSOPHY—FIRST AND SECOND GRADES.

1. Define matter, mass, density.
2. What is meant by ponderable and imponderable bodies? Illustrate.
3. What is meant by the line of direction? How does the line of direction govern the stability of a body? Illustrate.
4. What is a lever? How many kinds? Describe each.
5. Describe the steam boiler. The safety valve. The steam gauge.
6. How do fluids differ from solids? Difference between liquids and gasses?
7. How are bodies affected by heat? What classes of bodies are most susceptible of this action?
8. What is necessary to the transmission of sound? On what does the greater conducting power of the air depend?
9. Give a description of an electrical battery. How is it discharged?
10. Where in a bar magnet does the power chiefly reside? How are the extremities of a magnet distinguished?

NATURAL HISTORY.

1. Give the principal characteristics of the ruminants.
2. Give the different kinds of dentition.
3. How do the claws of a dog differ from those of a cat?
4. Describe briefly the process of "chewing the cud."
5. How do the bones of birds differ from the bones of mammalia?
6. Name the parts of a grass leaf.

7. Give the difference between feather-veined and palmate-veined leaves.
8. Give the principal kinds of inflorescence.
9. Give the parts of the seed.
10. How can you distinguish exogenous and endogenous plants in the seed already?

COMPOSITION.

(One credit off for each mistake in spelling, in punctuation, or in the use of capitals.)

1. What I have read.
2. Chinese Immigration.
3. Horticulture.
4. Physical Training of Children.
5. Out-of-door Life.

Write a composition on any one of the above subjects.

SPELLING.

1. vitalize,
2. prima facie,
3. pseudo,
4. legitimate,
5. circuitous,
6. Gila,
7. negotiate,
8. spontaneous,
9. glaciers,
10. Chihuahua,
11. siege,
12. anise-seed,
13. acquittal,
14. cephalic,
15. zoöphyte,
16. Versailles,
17. complaisance,
18. empiric,
19. fertility,
20. gaseous,
21. gasconade,
22. gew-gaw,
23. harangue,
24. Mediterranean,
25. demagogue,
26. ingratiate,
27. muscles,
28. woolen,
29. inherent,
30. tangible,
31. lachrymal,
32. farinaceous,
33. marvelous,
34. menage,
35. mollify,
36. nausea,
37. replete,
38. pageant,
39. paradigm,
40. parole,
41. recompense,
42. unequaled,
43. duteous,
44. abridgment,
45. courageous,
46. shoeing,
47. changeable,
48. benefited,
49. reference,
50. omission.

WORD ANALYSIS.

1. To each of the following words add an Anglo-Saxon prefix: *fetter, here, order, cargo.* Define and analyze each.

2. To each of the following words add an English suffix: *brother, apt, neutral, element.* Define and analyze each.
3. To each of the following words add an English prefix and suffix: *joint, arrange, form, offense, cent.* Define and analyze each.
4. To each of the following words add a Latin prefix: *occupy, committee, angelic, planter.* Define and analyze each.
5. To each of the following words add a Latin suffix: *fragile, clamor, supreme, verb.* Define and analyze each.
6. What do you understand by English, Anglo-Saxon, Latin, and Greek derivations? Give one example of each.
7. Give a synonym for each of the following words: *genuine, silence, civil, enough.*
8. Analyze each of the following words. (Four credits.)
   (No credits unless the roots and their meanings be given):
   1. Congregate—Excursion—Extemporaneous.
   2. Chirography—Allopathy—Automaton.

MUSIC.

1. Make the different kinds of notes, with their appropriate rests.
2. What is the value of a dot placed after a note? When two are used, what is the value of the second?
3. Place upon a staff with the proper signature, key of G, the following notes: la, mi, fa, si, sol, re.
4. Write five measures in triple time—no two alike.
5. How many major and how many minor seconds occur in the scale? Between what tones are the minor seconds found?

DRAWING.

1. Draw parallel lines in four positions.
2. How do horizontal lines appear in perspective?
3. What is meant by the *vanishing point?*
4. (Ten credits.) Give a freehand outline of a window, desk, or other piece of furniture in the room, as seen from the place where you sit. Pay strict attention to perspective and shading.

[QUESTIONS FOR QUARTERLY EXAMINATION, DECEMBER, 1873.]

ARITHMETIC.

1. Subtract one from one million. (See note above.)
2. Subtract $3\frac{4}{5}$ from $100\frac{1}{8}$. (See note above.)
3. Write one thousand eight hundred and fifty-seven according to the Roman method of notation. Write the following numbers according to the Arabic method: Five millions and twenty-seven; two billions, two hundred and seven millions, six hundred and four thousand and nine; five hundred seven septillions, two hundred three trillions, fifty-seven millions and eighteen. What is the use of the cypher?

4. What number is that, which being multiplied by 24, the product divided by 10, the quotient multiplied by 2, 32 subtracted from the product, the remainder divided by 4, and 8 subtracted from the quotient, the remainder shall be 2?
5. The capacity of a certain cistern is 216 cubic feet; how many hogsheads of water will it contain?
6. What is the least number of yards of velvet expressed by a whole number, that can be cut up without waste into patterns of $\frac{5}{8}$, $\frac{3}{4}$, or $\frac{6}{7}$ yards each?
7. If 5 oxen and 7 cows eat $3\frac{4}{11}$ tons of hay in 87 days, in what time will 2 oxen and 3 cows eat the same quantity of hay? Analysis and proportion.
8. I receive yearly $232 50 interest on $4,650 principal; what is the rate per cent?
9 At what rate must a note, running 60 days, be discounted to yield 2 per cent a month interest?
10. A certain general has an army of 144,376 men; how must he place them in rank and file to form them into a square?

MENTAL ARITHMETIC.

1. How many times 8 is $\frac{3}{4}$ of 56?
2. If 1 yard costs $62\frac{1}{2}$ cents what will 11 yards cost?
3. How many doz. of eggs, at 30 cts., would you exchange for 8 lbs. of butter at $37\frac{1}{2}$ cts. per lb.?
4. What is the difference between $\frac{1}{2}$ of 3 and $\frac{1}{3}$ of 2?
5. What change would you receive back in paying for a slate worth $37\frac{1}{2}$ cts. and a book worth $1 25, if you gave a $2 50 gold coin?
6. If John travels a mile in 25 minutes, how many miles will he travel in $3\frac{1}{3}$ hours?
7. What percentage of 56 is 14?
8. In a class $\frac{1}{3}$ study arithmetic, $\frac{2}{5}$ study grammar, and 12, being the rest, study reading. How many in the class?
9. What is the interest on $700 for 3 months, at 6 per cent per annum?
10. If you answer 7 questions (at $2\frac{1}{2}$ credits each) out of the 10, to what per cent will you be entitled?

GRAMMAR.

1. What is grammar? What is parsing? Give two rules for the use of the hyphen in compound words.
2. Write a sentence containing a noun in the first person; one containing a noun in the second person.
3. Write the plural of the following nouns: Mouse-trap, chimney, seraph, penny, volley. Give two rules for the formation of the plural of nouns ending in *o*, in *y*.
4. Decline the following nouns: Sheep, staff, valley, child. Compare the following adjectives: Eternal, most, white. Give the principal parts of the following verbs: Set, work, sue.
5. What is the difference between the expressions, "If I was," and

"If I were?" Write a sentence containing a perfect participle, and one containing an imperfect participle used without auxiliaries.
6. Name three different classes in which the following words are used, and give examples of each: That, as, but.
7. Correct the following sentences:
   (*a*.) Will you act thus towards me, I who have so often assisted you?
   (*b*.) He can neither read, write, nor speak.
   (*c*.) I did not either do it, nor prevent it.
   (*d*.) He is more bold and active, but not so wise and studious, as his companion.
   (*e*.) Let each esteem others better than themselves.
8. Parse the words, week, out, swing, like, and when, in the following stanza:

> *Week* in, week *out*, from morn till night,
> You can hear his bellows blow;
> You can hear him *swing* his heavy sledge
> With measured beat and slow,
> *Like* a sexton ringing the village bell,
> *When* the evening sun is low.

9. Analyze the following sentence:
   "I can't" never did anything; "I will try" has done wonders.
10. Arrange the following in a stanza of four lines, and correct the errors in spelling, punctuation, and the use of capital letters:
   now the bright morning star Days harbenger comes danceing from the East and leads with her' the flowerry may who from her green lap throws the yelow cowslip, and the pale primrose.

GEOGRAPHY.

1. Name the three largest rivers and three mountain ranges of South America.
2. Give the causes of the climate of Mexico. What are the leading characteristics of the people?
3. Name the principal rivers, cities, and exports of the United States.
4. What are the leading productions of California? Give the situation of the mountain ranges and largest rivers.
5. What are the characteristics of the climate and surface of Holland and Denmark? What are the principal occupations of the people? Do you believe that the contour of the country produces any effect on the minds and dispositions of the inhabitants? Reasons.
6. Give the largest cities of England, Scotland, and Ireland. Name the leading manufactures of each country, and state what differences exist between the people.
7. In what three divisions does Turkey lie? What is the largest city?
8. Name the principal rivers and mountains of France. What is the government of France at present, and how long has it been in operation?
9. By what seas is Italy nearly surrounded? What is the capital? What mountains extend through it? What can you say of the scenery?
10. Name the seas which border on Asia.

HISTORY OF THE UNITED STATES.

1. What was the first permanent French settlement made in America? What settlements were made by the Huguenots, and what was the result of each?
2. Give an account of the union of the New England colonies.
3. Name three wars in which the English colonists were engaged during the Colonial period, and give the cause of each.
4. When and where was Washington inaugurated? When was Washington City made the Capital of the United States?
5. What was the "Right of Search?" What dates do you think should be remembered by all?
6. Who is President of the Senate? and how are vacancies filled that may occur in the Senate or House of Representatives by resignation or otherwise?
7. What European nations claimed American territory, and what section did each claim?
8. Name five important battles that were fought during the Revolutionary War, and give the result of each.
9. What difficulty arose when California applied for admission into the Union? How was it settled?
10. What powers are granted by the Constitution to the President of the United States?

THEORY AND PRACTICE OF TEACHING.

1. How would you teach a class the reason for inverting the divisor in division of fractions?
2. Give a successful method in discontinuing the sing-song style in reading poetry.
3. What are the representative faculties of the human mind?
4. How would you *teach* history? What are the important dates that all should know?
5. Are you thoroughly acquainted with the provisions of the School Law? What change would you recommend for the benefit of the schools?
6. What would you teach a class concerning mountains?
7. What is the best work on education that you have read? Why do you think it the best?
8. What part of grammar do you give the most attention to in teaching? Why?
9. Tell what you know about the Kindergarten system.
10. What is the etymology, meaning, and application of the terms education, instruction, training, and drill.

ALGEBRA.

1. Factor $a\,x\,y^2+b\,x\,y^2-a\,b\,y^2-b^2\,y^2$.
2. Divide $x^2-a^2\,x-a^2\,x^2+5a^3\,x-6a^4$ by $x-a\,x+2a^2$.
3. Divide $\left\{\frac{1}{a}+\frac{1}{a\,b^3}\right\}$ by $\left\{b+\frac{1}{b}-1\right\}$.

4. Prove that $-x \times -x = +x^2$; and that $+x \times -x = -x^2$.
5. Given $2x+3y=23$; $5y+z=46$; $3z-2x=31$. Require the value of x.
6. Find two numbers differing by 7 and such that twice the greater may exceed 10 times the less by 10.
7. What is the difference between $\frac{n-1}{n}$ and $\frac{1}{n-1}$?
8. Given $12+x=\frac{x^2+12x}{5}$, what is the value of x?
9. The sum of two numbers is 8 and the sum of their cubes is 152. What are the numbers?
10. What number is that which, if 4 be subtracted from it, $\frac{1}{2}$ of the remainder will be 7?

PHYSIOLOGY.

1. Describe the location and functions of the salivary glands.
2. How are these glands injured by the constant use of tobacco or gum?
3. Give a brief account of the changes undergone by food in the process of digestion.
4. What reason can you give for the fact that large quantities of ice-water used at meals are injurious?
5. Of how many layers of membrane is the skin composed? Describe the arrangement of the papillæ.
6. Why are the muscles divided into voluntary, involuntary, and those combining the functions of both, instead of all being controlled in the same manner?
7. Describe the effect produced upon the muscles by over-exercise, and also by continued inactivity.
8. What is the office of the lymphatic vessels, and where are they most numerous?
9. Describe the arrangement of the bones which compose the foot.
10. What effects are produced by tight shoes and high heels?

NATURAL PHILOSOPHY.

1. How is *draught* caused? Give some familiar facts.
2. What produces *electricity?* and illustrate its production.
3. Difference between a *conductor* and a *non-conductor.*
4. Give Franklin's experiment to prove that *all rain-clouds are electric.*
5. Prove by familiar facts and an experiment that *a body floats if it has less weight than an equal bulk of water; it sinks if it has more.*
6. Prove the porosity of a solid.
7. From what results capillary attraction? Illustrate.
8. Give some applications of *elasticity.*
9. Prove by familiar facts and experiment *the refraction of light on passing obliquely through substances of different densities.*
10. Prove by experiment that *white sunlight is composed of the seven colors of the rainbow.*

PENMANSHIP.

1. Make and define the elements and principles used in forming the alphabet.
2. Analyze the following small letters by elements: a, f, r, s, k; and the principles in the following capitals: A, C, W, D, N.
3. Give two rules for spacing.
4. Describe two writing positions.
5. Give a specimen of your handwriting in accordance with the foregoing elements and principles, of not less than four lines.

NATURAL HISTORY.

1. (Ten credits.) When is a leaf simple, petiolate, exstipulate, featherveined, irregularly dentate, ovateacuminate, green, cauline, opposite?
2. (Twenty credits.) What is a head? a spike? a spadix? an ament or catkin? a raceme? a corymb? an umbel? a panicle? a glomerule? a compound corymb?
3. (Ten credits.) Give the different orders of birds.
4. (Ten credits.) Give the divisions of the animal kingdom.

COMPOSITION.

1. What is an essay; a theme?
2. Name five requisites for clearness of style.
3. Name the most important figures used in composition.
4. Write a composition on one of the following subjects:
   Influence of Education.
   Patriotism.
   Printing.
   Imagination.

READING.

1. Would you teach young children to pronounce words at sight, or would you permit them to spell the words before pronouncing? Reasons.
2. What is your opinion of concert reading as a means of teaching correct emphasis and the proper use of pauses?
3. How would you secure the attention of your class during an exercise of this kind?
4. What are the uses of the following pauses and marks: . , ( ) — ?
5. State what pauses should occur in the following passage; where they should be placed, and how you would teach children to observe them:

Two of us in the church-yard lie
My sister and my brother
And in the church-yard I
Dwell near them with my mother

SPELLING.

1. oxygen,
2. atmosphere,
3. capillary,
4. lymphatic,
5. sensibility,
6. temperature,
7. collegiate,
8. judicious,
9. Alleghany,
10. Antioch,
11. Tuolumne,
12. Suisun,
13. occupation,
14. deficiency,
15. enveloped,
16. diaphragm,
17. artificial,
18. electricity,
19. tortoise,
20. crystal,
21. excessive,
22. seized,
23. avaricious,
24. financial,
25. precious,
26. benevolent,
27. laudanum,
28. emphasis,
29. possession,
30. recollection,
31. yacht,
32. transient,
33. specie,
34. demeanor,
35. existence,
36. essential,
37. economy,
38. necessary,
39. receipt,
40. neutralize,
41. mechanism,
42. peculiar,
43. hemisphere,
44. familiar,
45. symptoms,
46. countenance,
47. conscious,
48. anticipate,
49. reigning,
50. excitable.

WORD ANALYSIS.

1. Define the following words, then change them to nouns by adding a suffix to each, and define the words so found: *advise, agile, elect, cater, respectable.*
2. What suffixes are used to form diminutives? Five examples showing the manner of using each.
3. Define and analyze the following words: *changeable, courageous, omission, acquittal, farinaceous.*
4. Define the following words, then add a prefix to each, and define the derivatives so found: *natural, monition, ordinary, ordain, close.*
5. Define the following words, add a prefix and suffix to each, and explain the modification which will be produced in the meaning: *base, friend, kind.*

MUSIC.

1. Make the six notes in common use, with their corresponding rests.
2. Write six measures in quadruple time, having no two measures alike in number of notes, introducing four kinds of rests.
3. Write the diatonic scale upon staff with G clef, key of C, placing under each note its letter and its syllable.
4. How many kinds of measure in general use, and what are they called?

5. Give an example of three varieties of the same kind of measure.
6. How many *major* seconds, and how many *minor* seconds in a diatonic major scale?
7. Give an example of the major third (3d); of the minor third (3d).
8. What letters form the scale in the key of G, F, D, and E flat?
9. Place notes upon staff with G clef, in key of C, triple measure, in position required by the following figures:

1. 3. 5. | 2. 8. | 3. 4. 5. 6. 7. 8 | 5. | 4. 2. | | ||

10. Write upon staff in key of G, $\frac{4}{4}$ measure, the following:

mi, re, mi, sol, | do, re, mi, | fa, mi, re, do, | si, do, sol, | si, do. ||

DRAWING.

1. What lines and angles are used in drawing? Describe them.
2. What is perspective?
3. Would you recommend the use of measures in drawing? Why?
4. Give a short lesson of instruction to a class engaged in drawing a chair or table in the room.
5. Draw the same yourself.

[QUESTIONS FOR QUARTERLY EXAMINATION, MARCH, 1874.]

ARITHMETIC.

1. There is a certain island 30 miles in circumference. If A and B commence traveling around it, A at the rate of 3 miles an hour, and B at the rate of 5 miles an hour, how far apart will they be at the end of 30 hours?
2. What is the greatest common divisor of 78, 234, and 468? What is the least common multiple of 14, 19, 38, and 57?
3. What will be the result if $\frac{1}{5}$ of $\frac{3}{4}$ of $3\frac{1}{8}$ be multiplied by $\frac{1}{2}$ of itself, and the product divided by $\frac{1}{2}$?
4. A certain room is 12 feet long, $11\frac{1}{2}$ feet wide, and $7\frac{1}{2}$ feet high. How much will it cost to plaster it at $2\frac{3}{4}$ cents per square foot?
5. If 6 men in 16 days of 9 hours each build a wall 20 feet long, 6 feet high, and 4 feet thick, in how many days of 8 hours each will 24 men build a wall 200 feet long, 8 feet high, and 6 feet thick?
6. I bought a horse, buggy, and harness, for $500; the horse cost $37\frac{1}{2}$ per cent less than the buggy, and the harness cost 70 per cent less than the horse. What was the price of each?
7. If I wish to obtain $1,500, for what sum must my note be given, payable in 30 days, and discounted at 1 per cent per month?
8. A broker receives $1,976 to invest in Government bonds, after deducting his commission at 4 per cent. What was the sum invested, and what was his commission?

9. Two ships sail from the same port; one goes due north 128 miles, the other due east 72 miles; how far apart are the ships from each other?
10. If a ball, 3 inches in diameter, weigh 4 pounds, what will be the weight of a ball that is 6 inches in diameter?

MENTAL ARITHMETIC.

1. If 7 books cost $8 75, what will 20 books cost?
2. A merchant bought a hogshead of molasses for $20; how much did he pay per gallon?
3. A house cost $560; $\frac{4}{7}$ of this + $80 is $\frac{1}{10}$ of the cost of the lot on which it stands. What was the cost of the lot?
4. If 4 pipes will fill a cistern in 3 hours, how many pipes of the same size will be required to fill it in $\frac{1}{3}$ of an hour?
5. A merchant sold a quantity of goods for $\frac{13}{18}$ of what they cost, and by so doing he lost $15. How much did the goods cost?
6. If to $\frac{1}{2}$ of the cost of A's watch you add $10, the sum will be $21; what was the cost of the watch?
7. Two men entered into partnership; the first put in $40 for 10 months, and the second put in $80 for 5 months; they gained $95. What was each man's share of the gain?
8. Five times a certain number minus 12 is 48. What is that number?
9. What principal will in 4 years, at 5 per cent, amount to $360?
10. A book was sold for 90 cents, which was 10 per cent less than its value. What would have been the gain per cent if it had been sold for $1 50?

GRAMMAR.

1. Name four different ways in which the nominative case may be used. Give an example of each.
2. What cases of the simple personal pronouns are changed to form the compound personal pronouns? How does the declension of the compound pronoun differ from that of the simple pronoun?
3. What is the adjective form of the verb; the noun form? What is an attribute, and what parts of speech may be used as attributes?
4. How does the perfect participle used without auxiliaries differ from the same used with auxiliaries? To what class of verbs does voice belong? How is the progressive form of verbs composed; the passive voice?
5. Give a synopsis of the following verbs according to the person, number, and form required:
   (*a*) "To think;" first person, singular, interrogative. Indicative.
   (*b*) "To teach;" third person, plural, interrogative, and negative. Indicative.
   (*c*) "To swear;" first person, plural, negative. Subjunctive.
   (*d*) "To take;" third person, singular, passive. Potential.
   (*e*) "To swing;" second person, singular, progressive. Indicative.

6. Correct the following sentences, and state the reason:
(a) Neither of those men seem to have any idea that their opinions may be wrong.
(b) He dare not do it.
(c) Either thou or I are greatly mistaken.
(d) I suppose it to be he.
(e) Have you no other proof except this?
7. Parse the words me, wild, expressed, while, and myself.

Me oft has fancy, ludicrous and *wild*,
Soothed with a waking dream of houses, towers,
Trees, churches, and strange visages, *expressed*
In the red cinders, *while* with poring eye
I gazed, *myself* creating what I saw.

8. Analyze the following sentence: True gentleness is native feeling hightened and improved by principle.
9. Correct and punctuate the following sentence: A royalist a republican a catholic and a patron of the synagogue a subaltern and a sovereign a christian and an infidel he was through all his vicissitudes the same stern and inflexible original
10. Give five rules for the use of the comma.

GEOGRAPHY.

1. Name the rivers of the Mississippi Basin; of the Mackenzie Basin; the lakes of North America; the largest city in Long Island. Between what two mountain systems is the Mississippi Basin?
2. What river flows through the northwestern part of California? Name the largest lake in the State; its outlet. Name the bays on the coast. What large river forms the southeastern boundary of California?
3. What large island at the mouth of the Amazon? What desert in the western part of South America? Name the divisions of Great Britain. Is there any difference between the climate of the British Isles and that of the eastern coast of North America in the same latitude? Why?
4. Name the peninsulas of Europe. What large islands between Europe and Africa? What divisions of Europe have a republican form of government?
5. On what waters would you sail from Lisbon to Bombay, via Suez Canal? Name the islands east of Asia; the principal islands which form the Empire of Japan. What divisions of the mainland of Asia are governed by European Powers?
6. What islands lie west of Africa? What strait separates Africa from Europe; from Asia? Name the largest lakes in Africa, and the outlet of each. Why is so little known concerning this one of the grand divisions?
7. Name the principal salt-water lakes in the world. Why do they contain salt water? Why does little or no rain fall on the western coast of South America?
8. What are winds, and how are they caused? What is the general direction of the winds in the tropical regions; in the temperate?

9. Upon what does the size of a river depend; the velocity?
10. Upon what does the temperature of a place depend? What is the cause of rain?

HISTORY.

1. Where and by whom were the following States settled: Massachusetts; New York; Maryland; Georgia; Ohio?
2. By whom were the following discoveries made: Florida; Mexico; Pacific Ocean; San Francisco Bay; St. Lawrence, Mississippi, Connecticut, and Hudson Rivers?
3. Name the principal settlements made by the English, Spanish, Swedes, Dutch, and French, within the limits of the United States.
4. Give an account of the cause, progress, and result of Bacon's Rebellion.
5. What caused the settlement of Massachusetts, Maryland, Pennsylvania, Georgia, and Rhode Island?
6. What purchases of territory have been made by the United States, what amount was paid for each, and what has been the gain to the country?
7. Name all the wars and insurrections that have occurred since 1789, and state the cause of each. What difficulties with foreign nations have been peaceably settled during the same time?
8. Give an account of the expedition against Cuba in 1850. What was the "Tripartite Treaty" proposed by England and France, and how was it received?
9. Name five Generals who commanded the Federal forces, and five who commanded the Confederates, during the Rebellion. What was the cost of the Rebellion?
10. What is the "Tenure of Office Bill," and why was it passed? Name five amendments to the Constitution.

THEORY AND PRACTICE OF TEACHING.

1. Define the difference between seeing and observing, and state what means you would employ to strengthen the latter habit.
2. How would you develop the ideas of number and form in a child?
3. How would you secure a habit of thought in a class?
4. Explain to a class why "*to-day*" is shorter than the corresponding day of June.
5. Should natural history be taught to children? Give the reason for your opinion.
6. How should children be taught definitions in geography?
7. In teaching arithmetic, what are the arguments in favor of keeping children for the first year at school on numbers less than 10, and of teaching them at the same time, addition, subtraction, multiplication, and division?
8. Explain to a primary class the process of dividing 675 by 6.
9. Give a brief outline of a lesson in local geography, to a class of beginners.
10. Name four practical exercises, independent of the text-book, for training a class in grammar.

ALGEBRA.

1. From $4a+4b$ take $3b-a$. Give reason for every step, as well as for signs. No credits without the explanation.
2. Multiply $(m+c)^2$ by $(m-c)^2$.
3. Divide y^5+33z^5 by $y+2z$.
4. Factor $a^2x-xb+a^3y^2-aby^2$.
5. What is the sum of $\frac{1}{a}+\frac{1}{b}+1-(\frac{a+b}{ab})$?
6. Divide 48 into two such parts, that if the less be divided by 4, and the greater by 6, the sum of the quotients will be 9.
7. The sum of three fractions is 2; the second fraction is double that of the first, and the third is double that of the second. What are the fractions?
8. Expand $(\frac{3}{2}-\frac{5}{3}x)^4$.
9. Find two numbers, such that the sum of their squares may be 89, and their sum multiplied by the greater may produce 104.
10. A May-pole is 56 feet high. At what distance above the ground must it be broken in order that the upper part, clinging to the stump, may touch the ground 12 feet from the foot?

PHYSIOLOGY.

1. How many bones in the human body, and how are they divided? Describe the arrangement of the bones of the wrist.
2. Describe the joints. What is cartilage; ligament; synovial membrane; tendon?
3. Name the digestive organs; the organs of circulation. State the course of the blood through the heart, arteries, and veins.
4. By what two sets of vessels is absorption performed? State the resemblance and the difference between them.
5. What is a common cause of loss of voice? How is the sound of the voice produced; by what is it varied; upon what does its strength depend?
6. What is the result if perspiration is suspended? What is the use of the oil glands; of the perspiratory glands?
7. Describe the arrangement of the brain and its membranes.
8. Name the different parts of the eye. Describe the arrangement of the coats and humors of the eye.
9. By how many muscles is the eye moved? What is the effect if either muscle is too short? Why should sudden transitions of light be avoided in using the eye?
10. Give the order of the transmission of sound through the different parts of the ear. What does acute hearing require?

NATURAL PHILOSOPHY.

1. Explain principle and action of *lightning rods.*
2. Why is it that meat must be cut, while bread may easily be broken?
3. Define and illustrate *adhesion.*
4. Why do we not feel the pressure of air exerted upon us?
5. Show that air, like any other body, maintains its place.
6. Give three familiar instances of an inclined plane.
7. Give the three important points in a lever.
8. Explain the action of the pendulum.
9. How does it come that our water-pipes can lead water to the upper part of houses, contrary to gravity?
10. To which class of levers does the wheelbarrow belong, and why?

PENMANSHIP.

1. Describe the proper manner of holding the pen.
2. What position and rests for arm and hand?
3. How many movements are used in writing, and what are they? Describe each.
4. Describe the elements and principles.
5. The length of the fifth principle being three spaces, what are the length in spaces of the different letters?

NATURAL HISTORY.

1. What different branches of the Natural Sciences constitute Natural History?
2. What is the difference between a simple and a compound leaf?
3. Name the component parts of a plant.
4. What are the common modes of arrangement of leaves on the stem?
5. Name and describe the different parts of a flower (blossom).
6. Give the principal characteristics of the carnivora.
7. Prove that the wings of birds correspond to the fore limbs of mammalia.
8. To which class of insects does the common house-fly belong; why?
9. Principal difference between a fly and a butterfly.
10. Principal difference between a fly and a spider.

COMPOSITION.

1. (5 credits.) What do you consider the proper foundation for a composition to be?

2. (5 credits.) What are the generally recognized rules for the use of capitals?

3. (15 credits.) Write an essay of not more than two pages and not less than one page, on either of the following subjects, viz: The beauties of nature; The Modoc war; Intemperance; The influence of woman; The proper aims of examinations.

READING.

1. State what pauses should occur in the following passage; where they should be placed, and how you would teach children to observe them:

> Two of us in the church-yard lie
> My sister and my brother
> And in the church-yard I
> Dwell near them with my mother

2. Scan the above stanza.

3. What is your opinion of concert reading as a means of teaching correct emphasis and the proper use of pauses?

4. How would you secure the attention of your class during an exercise of this kind?

5. What are the uses of the following pauses and marks: “ ” ; : — [ ] .

ORTHOGRAPHY.

1. changeable.
2. judgment.
3. fineness.
4. massacre.
5. separate.
6. receipt.
7. synopsis.
8. forehead.
9. ravenous.
10. enunciation.
11. benign.
12. chimera.
13. lyceum.
14. subpœna.
15. chevalier.
16. inveigle.
17. obeisance.
18. technical.
19. exquisite.
20. chemistry.
21. projectile.
22. vestibule.
23. pedagogue.
24. prejudice.
25. ventricle.
26. nitrogen.
27. sinecure.
28. depreciate.
29. hyacinth.
30. punctilious.
31. illicit.
32. villainous.
33. elixir.
34. assassinate.
35. zodiac.
36. frontispiece.
37. bronchia.
38. rheumatism.
39. reservoir.
40. sovereign.
41. wooliness.
42. variegate.
43. analysis.
44. aerial.
45. initiate.
46. electrify.
47. invidious.
48. artificer.
49. eulogize.
50. amateur.

WORD ANALYSIS.

1. Analyze and define: abed, dissimilar, impolite, supernatural, and conduce.

2. Give an example of words having the following suffixes: ar, er, ion, ment, ness. Define each.

3. Write five derivatives each from pure and blame. Give rules whenever changes are made in the primitives.

4. Combine and define docco+ile, finis+ite, lex+al, gaster+nomy, ab+norma+al.

5. Write five derivatives from cedo, and use them in sentences.

6. From what primitives are the following derived: object, collect, prelude, missive, and postpone?

7. Analyze and define astrology, geography, parenthesis, annul, and democracy.

8. Give an example of the correct use of enough and sufficient.

9. Give an example of the correct use of education and instruction.

10. Why are the names Sierra Nevada, metropolis, and hippopotamus given to their respective objects?

MUSIC.

1. Write five measures in triple time—no two alike.

2. What is the value of a dot placed after a note? When two are used, what is the value of the second?

3. Make the different kinds of notes, with their appropriate rests.

4. What is accent; rhythm?

5. What is the signification of *p*, *pp*, *f*, *ff*, *mf*?

DRAWING.

1. (5 credits.) What lines and angles are used in drawing? Describe them.

2. (10 credits.) Give a short lesson of instruction to a class engaged in drawing a table in the room.

3. (10 credits.) Draw the same yourself.

[QUESTIONS FOR QUARTERLY EXAMINATION, SEPTEMBER, 1874.]

ARITHMETIC.

1. Divide $\frac{35\frac{1}{2}}{49\frac{2}{3}}$ of $119\frac{1}{5}$ by $\frac{86\frac{5}{7}}{607}$ of $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{48\frac{1}{2}}{57}$.

2. What number must be multiplied by $45\frac{3}{5}$ that the product may be $17\frac{1}{2}$ times $123\frac{2}{7}$?

3. How many shingles will it take to cover the roof of a house

which is 60 feet long, and 56 feet wide, allowing each shingle to be 4 inches wide and 18 inches long, and to lie one third to the weather?

4. What is the smallest sum of money with which I could purchase a number of books at $\$2\frac{1}{4}$ each, a number of maps at $\$4\frac{1}{2}$ each, and a number of globes at $\$9\frac{3}{8}$ each? How many of each could I purchase?

5. A man has a garden that is $14\frac{1}{2}$ rods long and $10\frac{1}{4}$ rods wide; he wishes to have a ditch dug around it that shall be 3 feet wide and $4\frac{1}{2}$ feet deep; what will be the expense if he give 2 cts. per cubic feet?

6. Each of the four sides of a certain field appeared to be 2 furlongs, 30 rods, and 3 yards in length, when measured by a line supposed to be 4 rods long; but the line was found to have been only 64 feet in length. What was the true distance round the field?

7. What is the discount on $600 due 5 years hence at 5 per cent?

8. An agent received $8,960 with which to purchase flour after deducting his commission at 2 per cent. What is his commission?

9. A, B, and C engage in partnership with a joint capital of $1,000. A putting in stock for 7 months, B for 8 months, and C for 12 months. Of the profits A's part was $21; B's, $40; C's, $24. What capital was invested by each?

10. If a pipe 6 inches in diameter will draw off a certain quantity of water in 4 hours, in what time will 3 pipes of 4 inches in diameter draw off twice the quantity?

MENTAL ARITHMETIC.

1. How many feet in 2 rods, 3 yds., 2 ft., 11 in.?

2. I gave 15 pounds of sugar for 5 pounds of butter; how much did the butter cost a pound, provided 8 pounds of sugar were worth 56 cts.?

3. How many men can perform the same amount of work in 10 days that 8 men can perform in 5 days?

4. If a boy can do a piece of work in 40 minutes, how many hours would it take him to perform 12 times as much work?

5. If in $3\frac{4}{7}$ hours A can do a piece of work, how long will it take him to do a piece of work $1\frac{2}{5}$ times as large?

6. If 4 horses eat 16 bushels of grain in 2 days, how many bushels will 3 horses eat in 12 days?

7. A gentleman, after spending $\frac{3}{7}$ of his fortune and $\frac{1}{2}$ of the remainder, had $2,400 remaining. What was his fortune?

8. A farmer gave 35 bushels of rye to two of his poor neighbors; to the first he gave 1 bushel as often as to the other $\frac{3}{4}$ of a bushel. How many bushels did each receive.

9. A and B can build a boat in 20 days, and with the assistance of C they can build it in 8 days. How long would it take C to do it alone?

10. If a man can chop a cord of wood in $\frac{3}{7}$ of a day, how much can he chop in one day?

GRAMMAR.

1. Give the plural of the words rookery, knife-blade, child, spasm, staff, mercy, madam, this, him, and James.

2. Give the possessive, singular and plural, of the words mouse, church, lesson, fox, and I.

3. Give a synopsis of the verb *bid* in the potential and subjunctive moods, third person and singular number.

4. What parts of speech are used as attributes? Give examples of each.

5. Write two sentences—one having a transitive and the other an intransitive verb.

6. Write, first, a simple sentence; second, a complex sentence; and third, a compound sentence.

7. Analyze "I dare not think upon thy vow, and all it promised me, Mary."

8. In the foregoing sentence, parse think, thy, all, promised, and Mary.

9. Correct the incorrect sentences in the following, and give reasons:

He should have went yesterday.
I recited my lesson to-day.
Mary or John lost her hat.
James is the larger of the two.
I have seen it done.

10. Punctuate and capitalize the following, and give reasons:

and this to me he said
an twere not for thy hoary beard
such hand as marmions had not spared
to cleave the douglas head

GEOGRAPHY.

1. Between what mountain chains is the great plateau of North America? Name three divisions of this region.

2. Name the bodies of water on which you would sail from Constantinople to St. Petersburg.

3. Through what countries would you travel from Lisbon to Calcutta?

4. With what does the general direction of mountain ranges accord? Give examples.

5. What four classes of lakes are there? Give an example of each.

6. Name the three principal hurricane regions. Why does more rain fall in the Northern than in the Southern Hemisphere?

7. Name the principal food plants of the Torrid Zone; of the Temperate; of the Frigid.

8. What seas border on Russia? What division of Europe has no sea coast; of Asia?

9. Under what government is the greater part of Hindoostan? Name the principal rivers of Hindoostan.

10. What form of government has Mexico; Greece; Holland; Turkey; Siberia; China; Algiers; Egypt; Persia; Liberia?

HISTORY OF THE UNITED STATES.

1. Give the principal discoveries made by Columbus.

2. Describe briefly the colonization of Massachusetts and Connecticut.
3. Describe briefly the colonization of New York, and how it became an English colony.
4. How did the United States acquire California, and how did California obtain its present population?
5. What was the first Continental Congress, and when and for what did it meet?
6. Give the meaning and object of the Centennial to be celebrated in Philadelphia, in 1876.
7. For what purpose, and by whom (omitting names), was the present Constitution of the United States formed?
8. State briefly the cause, object, and result of the war of 1812.
9. Give a very brief outline of the beginning, progress, and end of the War of Secession.
10. How is the United States Government supported, financially?

THEORY AND PRACTICE OF TEACHING.

1. To what extent should memory be cultivated?
2. What is phonic spelling, and what do you consider the advantages of its use?
3. How would you introduce the study of grammar into a class which has no knowledge whatever of the subject?
4. Give your methods of teaching spelling.
5. What means would you adopt to prevent the hesitation and stumbling so common in reading?
6. Do you think the introduction of music and drawing into the lower grades of our schools has a beneficial effect upon the scholars? Why?
7. How would you require your scholars to explain the process of subtracting 7,694 from 24,302?
8. Do you think the division of large classes into sections, for alternate study and recitation, a useful practice? Why?
9. Do you believe in concert exercises in primary classes? Why?
10. What do you think of Teachers' Institutes as means of promoting the cause of education?

ALGEBRA.

1. What does a parenthesis or a vinculum indicate? How is equality indicated? Inequality? What is an axiom?
2. Prove that in algebra, addition does not always imply augmentation, and subtraction not always diminution.
3. Multiply $7xy-14x^2y^2+21x^3y^3$ by $6xy-3$. $6a^2b-9ab^2-12a^2b^2$ by $2ab-3b^2$.
4. Divide $ax-ay+bx-by+z$ by $x-y$. m^6-n^6 by m^2+mn+n^2.
5. Find the prime factors of a^6-1; of $8-c^3$.
6. Reduce $\frac{4a^2-8ab+4b^2-2a}{2a-2b}$ to an integral or mixed quantity.
7. Find three numbers, such that one half of the first, one third of

the second, and one fourth of the third, shall together be 56; one third of the first, one fourth of the second, one fifth of the third, 43; one fourth of the first, one fifth of the second, and one sixth of the third, 35.
8. A man meeting some beggars, gave 3 cents to each, and had 4 cents left. If he had undertaken to give 5 cents to each, he would have needed 6 cents to complete the distribution. How many beggars were there, and how much money did he have?
9. A merchant bought a piece of cloth for $45, and sold it for 15 cents more per yard than he paid. Though he gave away five yards, he gained $4 50 on the price. How many yards did he buy, and at what price per yard?
10. Find two numbers whose difference is 3, and the sum of whose squares is 117.

PHYSIOLOGY.

1. Of what are the joints composed? Describe each part.
2. Give the structure of the muscles, and describe their union to the bones.
3. Describe the position, structure, and use of the diaphragm.
4. Why do muscles increase in size when properly exercised? On what does muscular strength depend? endurance?
5. What is the pericardium, and what is its use?
6. What are veins; arteries; capillaries?
7. What is meant by cutaneous absorption; respiratory absorption? Illustrate.
8. Describe the change which the venous blood undergoes in the lungs.
9. Of how many layers is the skin composed? Describe each. On what does the color of the skin depend?
10. What can be said of the influence of the sympathetic nerve? Illustrate.

NATURAL PHILOSOPHY.

1. What is specific gravity? Illustrate.
2. Why is the hand wet when drawn out of water, and dry when drawn from mercury?
3. In drawing water from a well, why has the bucket more weight as it emerges from the water?
4. Explain the principle of inhalation and exhalation. Give another illustration of the same principle.
5. Why are the walls of safes often filled with fine ashes? Give two other applications of the same principle.
6. Explain the action of the thermometer.
7. What is evaporation? Illustrate.
8. Explain the action of the hydraulic press.
9. Why can a person's voice be heard farther on a calm lake than on land?
10. What is inertia? Give two examples of its application.

CONSTITUTION OF THE UNITED STATES AND OF CALIFORNIA.

1. Draw a parallel between the Constitution of the United States and that of California.
2. Show the similarities between the duties of the Governor of this State and of the President of the United States.
3. Give briefly the organization of our State Judiciary.
4. The same of the United States Judiciary.
5. How and when may a foreigner become a citizen?

SCHOOL LAW.

1. Who compose and what are the duties of the State Board of Education?
2. How is the State School Fund raised and apportioned?
3. Give five duties of teachers enumerated in the School Law.
4. How may County, City, and State Boards of Examination be guilty of misdemeanors?
5. For what causes may a teacher's certificate be revoked?

PENMANSHIP.

1. Name and form the elements and principles used in the Payson, Dunton & Scribner's System of Penmanship.
2. Analyze: *A; q; r; W; v.*
3. Tell all you know about the scale of proportions in letters.
4. Write the small letters.
5. Write the capitals.

NATURAL HISTORY.

1. Into what two great classes are vegetable forms divided?
2. Name the various organs of plants.
3. What is meant by a species; a genus?
4. What are the parts of a perfect plant?
5. Name the different parts of a flower.
6. What are the functions of leaves?
7. Name the four grand divisions of the animal kingdom.
8. Name five points of difference between animals and plants.
9. Of what does the nervous system consist in articulated animals.
10. Name two animals of each grand division of the animal kingdom.

COMPOSITION.

1. Give one rule for the use of each of the following points: comma, semicolon, colon.

2. Name the principal styles used by different authors, and define two.
3. Give two rules which will tend to produce strength of style.
4. Write a composition of not less than one page, or more than two pages, on any one of the following subjects: Chivalry; Ambition; Napoleon I; Mountains; Earth's Battle-fields; I Told You So.

READING.

1. What are two of the first requisites of good reading?
2. Give one rule for the use of each, the rising and the falling inflection?
3. Make and define the marks used in punctuation.
4. Scan the following stanza:

> O, the young Lochinvar is come out of the west,
> Through all the wide borders his steed was the best.
> And save his good broad-sword, he weapons had none,
> For he rode all unarmed, and he rode all alone.

5. Describe an exercise which you think calculated to produce distinct articulation.

SPELLING.

1. elaborate.
2. achieving.
3. suspicious.
4. centennial.
5. recitation.
6. panacea.
7. complainants.
8. decision.
9. litigation.
10. deceased.
11. commissioner.
12. ruralizing.
13. lieutenant.
14. business.
15. venire.
16. Cincinnati.
17. carbonaceous.
18. hydrophobia.
19. assassinate.
20. surgeon.
21. statisticians.
22. machine.
23. requisite.
24. reservoir.
25. phlebotomy.
26. medicinal.
27. physician.
28. lawyers.
29. elixir.
30. cesspool.
31. exemplary.
32. raisins.
33. separate.
34. seized.
35. luxurious.
36. inciting.
37. telegrams.
38. legislature.
39. prosecute.
40. equity.
41. necessary.
42. preliminary.
43. apportionment.
44. adjudication.
45. paragraphs.
46. sufficiently.
47. sorcery.
48. technical.
49. sumach.
50. Tucson.

WORD ANALYSIS.

1. Supply prefixes to the words calm, dew, body, number, and crown, to form verbs.
2. Combine and define: mercy+full; beauty+ous; pure+ity; re+crimin+ate+tion; and abridge+ment.
3. Analyze celebrity, cordial, superfluous, congregate, and itinerate.
4. Write sentences containing *act* as a noun and a verb; also, sentences containing *gallant*, and giving its different meanings.
5. Write five derivatives, each derived from *finis* and *cedo*.

MUSIC.

1. What are ledger lines, and why are they used?
2. When are bars and double bars used? What name is given to the divisions of a piece of music caused by their use?
3. Write five measures in sextuple time—no two measures alike.
4. Write the major scale in the key of E
5. What is the meaning of cres., dim., D. C., p., pp.?

DRAWING.

1. Name and draw the different lines and angles used in drawing.
2. What is perspective?
3. Draw:
   First—Two different triangles, two different quadrilaterals, and two different pentagons.
   Second—Some elementary figures you would use in teaching a division of the third grade.
   Third—Draw any piece of furniture in the room in which you are sitting, paying attention to perspective and shading.

[QUESTIONS FOR QUARTERLY EXAMINATION, DECEMBER, 1874.]

ARITHMETIC.

1. Divide 8,786,742 by the factors 7, 5, and 2. Explain the principle of obtaining the true remainder.
2. What is the greatest common divisor and the least common multiple, of the numbers 18, 36, and 24? Explain the principle of obtaining each.
3. What is the difference between 2 m., 5 fur., 6 rds., 3 yds., 2 ft., 7 in., and 7 fur., 39 rds., 4 yds., 2 ft., 8 in.? Prove your work by subtraction in decimals.
4. Write in words and analyze the following fractions: $\frac{4}{4}$, $2\frac{1}{3}$, .3, and .00007.
5. If $\frac{2}{3}$ of 7 tons of coal cost $\$93\frac{1}{3}$, what will $\frac{3}{4}$ of 5 tons cost? Work by analysis and prove by proportion.

6. What will it cost to build a wall 650 ft. long, 8 ft. high, and $2\frac{2}{3}$ ft. thick, at $9 75 per 1,000 bricks—each brick being 8 inches long, 4 inches wide, and 2 inches thick?
7. A grocer sold 4 barrels of sugar for $30 each; on two barrels he gained 20 per cent, on the other two barrels he lost 20 per cent; did he gain or lose on the whole?
8. A man received $\$16\ 12\frac{1}{2}$ interest on a sum of money, which had been loaned $3\frac{1}{3}$ years at 9 per cent. What was the principal?
9. A flagstaff 75 feet high stands in the center of a square lot containing two acres; what is the length of a rope extending from one corner to the top of the staff?
10. Extract the cube root of $\frac{9}{21\frac{1}{3}}$. What are the names of the units used in the metric system for length, surface, solid, capacity, and weight?

MENTAL ARITHMETIC.

1. Paid $2 50 for 5 yards of ribbon, at $12\frac{1}{2}$ cents per yard, and 3 books at $37\frac{1}{2}$ cents each. How much change did I receive back?
2. What per cent of 60 is 12?
3. How many men can perform the same amount of work in 12 days that 6 men can in 4 days?
4. If a man travels 1 mile in 20 minutes, how many hours and minutes will it take him to travel 17 miles?
5. If A and B can do a piece of work in 4 days, and A can do it alone in 6 days, how long would it take B to do it?
6. A man being asked how many sheep he had, replied that if he had one and one half times as many more, and $2\frac{1}{2}$ sheep, he would have fifty. How many had he?
7. A man after spending one half of his money and one third of the remainder, had $10 left. How much had he at first?
8. How many car tickets, at $6\frac{1}{4}$ cents each, can be purchased for $7 50?
9. How long will it take a man to clear $100 if he gets $1 50 a day, and pays $4 a week for board?
10. If you get $2\frac{1}{2}$ credits each for 8 questions out of 10, what will be your percentage?

GRAMMAR.

1. Compare two adjectives by means of adverbs of increase; two by adverbs expressing degrees of diminution; two irregularly; and name five which cannot be compared.
2. What are the two principal classes of adjuncts? Write a sentence containing both classes. Name three kinds of adjective adjuncts.
3. Give a synopsis of the verb *sit*, in the first person, singular number, indicative and subjunctive moods.
4. Correct all mistakes in the following sentences, and give reasons for your corrections:
   Neither he nor I expects to be present.
   He has two brothers, one of which I am acquainted with.

Neither Alice, Kate, nor Mary have performed their task.
The work has been finished last week.

5. What are moods in grammar? Write a sentence containing a verb in the subjunctive mood, singular number, present tense.

6. Analyze the following sentence:

He that has light within his own clear breast,
May sit in the center and enjoy bright day.

7. In the following sentence, parse the words in italics:

The *honey-bee* that wanders all day long,
The *field*, the *woodland*, and the *garden* o'er,
To gather in his fragrant Winter store,
Seeks not alone the rose's glowing breast.

8. What parts of speech may be used as subjects? Write sentences illustrating the use of each.

9. Punctuate and capitalize the following:

"the groves were god's first temples ere man learned
to hew the shaft and lay the architrave
and spread the roof above them ere he framed
the lofty vault to gather and roll back
the sound of anthems he knelt down
and offered to the mightiest solemn thanks."

10. What are simple, complex, and compound sentences? Give an example of each.

GEOGRAPHY.

1. Name and locate the principal peninsulas of Europe; of Asia.
2. Where are the Carpathian Mountains? Balkan Mountains? Ural Mountains? Where is the Volga River? Danube River?
3. Describe the general surface of Holland; England; Scotland; Brazil; Mexico.
4. Where are the desert regions of the United States and South America, and how are they produced?
5. In going by water from Stockholm to Bordeaux, through what waters would you pass?
6. Edinburgh and Moscow are in the same latitude; are their climates the same? Why?
7. What are the deltas of rivers, and how are they formed? Name two rivers which are remarkable for their deltas.
8. What is a watershed? What is the principal watershed of the United States?
9. What is snow, and how is it produced? Name two of the principal uses of snow?
10. What are isothermal lines? Why do not the isothermal lines coincide with the parallels of latitude?

HISTORY OF THE UNITED STATES.

ı and where did the first Colonial Congress meet? How ıies were represented? The first Continental Congress?

2. What were the Articles of Confederation, and when were they adopted?
3. What was the cause of Shay's Rebellion? of the Whisky Rebellion? When and where did each occur?
4. State the principal events of John Adams' administration.
5. Give an account of Dorr's Rebellion, and of the troubles in Kansas in 1855.
6. What difficulty occurred with Great Britain during 1852?
7. Name five events which led to the War of Secession.
8. Name the States which have been formed out of the Louisiana purchase.
9. Give an account of the Texan Revolution.
10. Name the principal events of Lincoln's administration.

THEORY AND PRACTICE OF TEACHING.

1. Give briefly the benefits derived from a study of etymology.
2. Explain Grube's method of teaching primary arithmetic.
3. Explain, as if to a class, the subtraction of 1 from 1,000,000.
4. What are the reasons for introducing drawing into the primary classes?
5. How should composition be taught?
6. How would you introduce the study of plants?
7. How do you determine whether a pupil has studied a history lesson?
8. What benefits does the pupil derive from the study of geography?
9. What is the object of teaching physiology?
10. How should spelling be taught? Give the reasons for your opinion.

ALGEBRA.

1. What is a reciprocal? Zero power? Negative exponent?
2. Find the prime factors of $6x^2+xy-9x-y^2+3y$.
3. Divide a by $\frac{x}{x+y}\times\frac{a}{x-y}$
4. What is the greatest common divisor and the least common multiple of x^2-4a^2, $(x+2a)^3$, and $(x-2a)^3$?
5. If B gives A $5 of his money, A will have twice as much as B has left; but if A gives B $5, then A will have but three fourths as much as B will have. How much has each?
6. Extract the square root of $a^4-a^3b+\frac{3a^2b^2}{4}-\frac{ab^3}{4}+\frac{b^4}{16}$
7. A merchant sold a piece of cloth for $39, and gained as much per cent as it cost him. How much did it cost him?
8. Divide $7y^2$ by $\frac{10ax}{3by}$
9. Two houses standing on opposite sides of a street 84 feet in width,

are respectively 67 and 54 feet in height. What length of rope will reach from the top of one house to the top of the other?

PHYSIOLOGY.

1. Give the structure of the muscles. How are they attached to the bones?
2. Why should food be well masticated before being swallowed, and why should it be masticated and swallowed without the aid of drink?
3. Give a brief outline of the action of the circulatory organs.
4. Name the divisions of the nervous system. Of what two portions is the center of the nervous system composed? Describe the brain.
5. Describe the stomach and its functions.
6. Give three reasons why the lungs should be kept in a healthy condition, and pure air breathed.
7. Name and describe three tissues, and state the uses of each.
8. What mechanical principle is illustrated in the action of the elbow joint? Give the construction of the joints.
9. Why should we not engage in intense mental exertion immediately before or after eating heartily?
10. Name the organs of taste. Describe their action.

NATURAL PHILOSOPHY.

1. Mention a force which may overcome gravity. Illustrate.
2. Why does ice float on water?
3. Define the following terms: tenacious, elastic, brittle, malleable, ductile, inertia.
4. What is the inclined plane, and what are its applications?
5. What are sound waves? What is the velocity of sound?
6. Is all aqueous vapor visible? Why do clouds stay in the air?
7. What are self-luminous bodies? Name five.
8. When is a body said to be colored, white, black.
9. Why do clear waters appear more shallow than they are?
10. Compare the magnet with the electro-magnet, giving five points in common, and three of difference.

CONSTITUTION OF THE UNITED STATES AND OF CALIFORNIA.

1. Who is President of the United States Senate? When is he entitled to vote?
2. Name the branches of the United States Government. Name the Executive Departments.
3. In how many ways may a bill introduced into Congress become a

Vhat powers are denied to States?

5. What qualifications are necessary for President of the United States? for United States Senator? for Representative?
6. In what does treason against the United States consist? What testimony is necessary for conviction?
7. In what cases has the United States Supreme Court original jurisdiction?
8. Who is President of the California State Senate?
9. By whom are Notaries Public appointed? What are the duties of these officials?
10. Name and describe the various Courts of which our State judicial system is composed.

SCHOOL LAW.

1. Give the law in relation to the length of the daily sessions of public schools, and state the penalty in case of its violation.
2. How must all State and county school moneys be apportioned?
3. How long must any series or part of a series of school-books be continued in use, and what is the penalty in case any city or district refuse or neglect to use the books which may be prescribed?
4. What provision is made for the support of District Libraries?
5. Name five powers of Boards of Trustees or Boards of Education?

PENMANSHIP.

1. Describe the position of body, arms, hands, fingers, book, and pen in writing.
2. Describe the fore arm, the hand, and the pen-finger's movements.
3. Name four particulars to be noticed in forming letters; two in forming words.
4. Write the elements and principles used in writing, and give letters illustrating each.
5. Write an application for a position as teacher of penmanship. State in what particulars you fail as a scientific penman.

NATURAL HISTORY.

1. Difference between the dentition of the horse and the dentition of the cow.
2. Give the general characters of an insect.
3. What is a species? a genus? an order?
4. Name the four (Agassiz) or five (Huxley) grand divisions into which the animal kingdom is divided, and give the general characters of each division.
5. Give the general characters of the two divisions of phanerogamous plants.
6. What is a perennial? an annual? a biennial plant?
7. Name and describe the four divisions of vertebrates.
8. Describe a grass-leaf.

9. Describe the germination of a seed.
10. Describe an oak.

COMPOSITION.

1. Define redundancy, tautology, pleonasm, irony, and simile. Give an example of each.
2. What is style? Name and define the different kinds of style.
3. What are figures of speech? Name and illustrate.
4. Write a composition of not less than one page, nor more than two pages, on one of the following subjects:

    Queen Elizabeth.
    Battle-fields.
    Pictures.
    Beauty and Sublimity.
    Whatever is, is right.

READING.

1. In the following extract, italicize the words to be emphasized; mark the rising or falling inflection when required:

He knew no motive but interest; acknowledged no criterion but success; he worshiped no God but ambition; and with devotion he knelt at the shrine of idolatry. Subsidiary to this, there was no creed he did not profess; there was no opinion he did not promulgate; in the hope of a dynasty, he upheld the crescent; for the sake of divorce, he bowed before the cross; the orphan of St. Louis, he became the adopted child of the republic; and with a parricidal ingratitude, on the ruins both of the throne and the tribune, he reared the throne of his despotism.—[McGuffy's Fifth Reader, page 34.

2. Scan the following lines:

    There stands a shrewd barber, with razor and pan,
    Both tattling and shaving as fast as he can;
    No man in the village has got more to say
    Of weather and wind, and the news of the day.

3. Mark the proper poetical pauses in the above stanza.
4. If in the first line of the above stanza, we should emphasize *there*, what would we thereby indicate? If *stands* were emphasized? If *shrewd* were emphasized? If *barber* were emphasized? If *razor* were emphasized? Which word should be emphasized?
5. What variations of the voice in reading are included under *modulations?*

SPELLING.

1. efficiency.
2. complicity.
3. maneuvered.
ncessantly.
ivilization.
annihilate.
mucilage.
8. auxiliary.
9. phenomena.
10. Valparaiso.
11. controller.
12. hygiene.
13. intellectual.
14. lachrymose.

15. tranquilize.
16. subversion.
17. Cincinnati.
18. predecessor.
19. hemorrhage.
20. melancholy.
21. dyspepsia.
22. chronology.
23. liquefy.
24. alienate.
25. merchandise.
26. neutralize.
27. mischievous.
28. iniquitous.
29. vehement.
30. cynical.
31. feign.
32. prophesy.
33. solecism.
34. pleurisy.
35. sovereign.
36. adjournment.
37. fertilize.
38. embezzlement.
39. analytic.
40. circumstantial.
41. dissyllable.
42. inapproachable.
43. scientific.
44. solicitous.
45. medicinal.
46. inaccessible.
47. Los Angeles.
48. Tennessee.
49. Edinburgh.
50. Minnesota.

WORD ANALYSIS.

1. Define the following prefixes: em, mis, out, with, un, a, over, be, fore.
2. Define the following prefixes: ad, ab, de, dis, juxta, re, sine, ultra, circum, contra.
3. Define and give the origin of the following prefixes: amphi, apo, dia, hyper, meta.
4. Define the following suffixes: ate, ician, ling, ster, ary, ics, dom, acious, eous, ose.
5. Analyze the following words: absorption, benevolent, carboniferous, circumscribe, deduce, eradicate, fortification, gymnastic, horticulture, ignoble.
6. Define the following words: jurisdiction, lassitude, lethargy, malevolent, novice, oleaginous, paradox, retrograde, revocation, solecism.
7. Write sentences containing the following words: tenable, topography, virulent, unvitiated, secular.
8. Write *a sentence* containing the following words: facilitate, rescue, mischievous, innovation, perpetually.
9. Name five derivatives each, from molest, line, lax, just, guard.
10. Explain the difference between the following words: bravery and courage; translucent and transparent; veracity and truth; understand and comprehend; modern and recent.

MUSIC.

1. Define staff, added lines, cleff, staccato marks, chords, rythm, pitch, bar.
2. Write four measures in the key of D, no two measures alike, $\frac{3}{4}$ time, and indicate that they are to be repeated.

3. How many sixteenth notes are equal to a pointed half? How many to a double pointed quarter?
4. When the signature of a piece is three flats, between what letters do the semitones occur? In the foregoing signature write on a staff, the letters composing an octave, showing where the semitones occur.
5. Give the use of the following letters and marks used in music: p, pp, f, ff, mf, D. C. ⌒, 𝄐 < >.

DRAWING.

1. What relation does geometry bear to drawing? How much of it should be taught in the common schools?
2. Define perspective drawing, and give the fundamental principles upon which it is based. Illustrate.
3. What is "memory drawing?" Its use?
4. Give some examples of designing adapted for a third grade (primary) class.
5. How and when should model and object drawing be introduced?

[QUESTIONS FOR QUARTERLY EXAMINATION, MARCH, 1875.]

ARITHMETIC.

1. Prove that in dividing by a fraction we invert the divisor and then proceed as in multiplication.
2. If 18 men consume 34 barrels of potatoes in 135 days, how long will it take 45 men to consume 102 barrels? Work by both analysis and proportion.
3. A, B, and C engage in a speculation, towards which A contributes $480, B contributes $720, and C contributes $1,200. If they gain $650, what does each gain? Work by both analysis and proportion.
4. What is the bank discount on a note for $350, payable 90 days after date, without grace, at 7 per cent?
5. A note having 90 days to run, at the rate of 7 per cent, is to be made so that the proceeds shall be $2,050; what is the face of the note?
6. Find the cost of a draft on New York for $1,400, payable 60 days after sight, exchange being worth $102\frac{1}{2}$ per cent, and interest being reckoned at the rate of 7 per cent per annum.
7. A real estate broker purchased a house for $21,300, on which he was to receive a commission of $1\frac{1}{4}$ per cent. After a few days he was directed to sell the property again, which he did, obtaining an advance of twenty per cent on the purchase price. Allowing the same rate for selling as for buying, what was his total commission?
8. A merchant in New York sends $12,600 to a commission merchant in Chicago, to buy flour, agreeing to pay 5 per cent on the cost of the flour for commission; how many barrels of flour does he receive, the market price being $12 per barrel?
9. Let $140 be divided into three parts, proportional to 3, 5, and 6.
10. Give the principles on which the solution of proportions depends. Illustrate.

MENTAL ARITHMETIC.

1. If $\frac{3}{50}$ of the principal equals the interest, what is the rate per cent?
2. A woman bought a quantity of oranges for 75 cents, and sold them for 84 cents. How much did she gain per cent?
3. A man bought a hat, a coat, and a vest, for $40. The hat cost $6; the hat and coat cost 9 times as much as the vest. What was the cost of each?
4. Divide 88 into two such parts that shall be to each other as $\frac{2}{3}$ is to $\frac{4}{5}$.
5. Reduce $\frac{3}{8}$ to its equivalent decimal.
6. A book was sold for 90 cents, which was 10 per cent less than its value. What would have been the gain per cent on its value if it had been sold for $1 50?
7. A farmer sold two horses, at $210 each; for one he received 25 per cent more than its value, and for the other 25 per cent less than its value. Did he gain or lose by the sale of both, and how much?
8. A merchant, by selling 40 yards of cloth for $160, lost 20 per cent. What did the cloth cost per yard?
9. A man, after spending $\frac{3}{4}$ of his fortune, found that $20 was $\frac{2}{9}$ of what he had remaining. What was his original fortune?
10. A is 40 years old, and $\frac{3}{4}$ of his age is $\frac{3}{5}$ of twice as much as his wife's age. How old is his wife?

GRAMMAR.

1. Name and illustrate five forms of conjugation. Name and give examples of four ways in which the nominative case may be used.
2. When must nominatives connected by *and* have a verb in the singular number? What classes of words are used as connectives in complex sentences?
3. Name three different ways in which the words *but*, *for*, and *since* may be used. Give examples. Write a sentence in which the word *as* is a relative pronoun.
4. When should the reciprocal pronouns *one another* and *each other* be used? The correlative conjunctions *so as* and *as as?*
5. When may several verbs, having but one subject, be connected by the conjunction *and?*
6. Correct the errors in the following sentences, and state your reasons:
   (*a*) He, and not I, am chosen.
   (*b*) You or he is in the wrong.
   (*c*) Hoping that I shall soon hear from you, believe me yours truly.
   (*d*) My father's and mother's command was obeyed.
   (*e*) Day and night are a consequence of the earth's revolving on its axis.
7. (*a*) Much depends on this rule being observed.
   (*b*) Every person is the architect of their own fortune.
   (*c*) Who should I meet the other day but him.
   (*d*) An adjective or participle must belong to some noun or pronoun.

(*e*) I do not doubt but that I will succeed.

8. Parse the words *when*, *all*, *as Winter*, and *rolling*, in the following:

On Linden when the sun was low,
All bloodless lay the untrodden snow,
And dark as Winter was the flow
Of Iser, rolling rapidly.

9. Analyze the preceding sentence.

10. Parse the italicised words in the following sentences: "I understand *it to* be *him*." "It is not *worth while* to go." "*Than whom* none higher sat."

GEOGRAPHY.

1. Name ten of the largest cities in the United States.
2. Name the principal imports from Europe; from Asia; from South America; from Oceanica; from the West Indies.
3. For what are the following cities noted: Hamburg, Lyons, Liverpool, Belfast, Rome, Glasgow, Bordeaux, Brussels, Manchester, and Pittsburg. State the location of each.
4. What capes form the extremities of the grand divisions?
5. Name the principal branches of each of the five oceans.
6. In what parts of the world are the following metals principally found: Gold, silver, iron, copper, and lead?
7. On what does the temperature of the land of the earth depend; of the ocean; of the atmosphere; of springs?
8. What are oceanic rivers; continental rivers; solitary islands; coralline islands, continental islands? Give an example of each.
9. What are the principal oceanic currents? Name some of the causes which produce them.
10. What is the most important obstacle to the navigation of the Mississippi River; of the Ohio; of the Missouri; of the Red River; of the Sacramento?

HISTORY OF THE UNITED STATES.

1. Give a brief description of the first English colony founded in Virginia, and state how it differed from the first English settlement made in New England.
2. Name the principal causes of the French and Indian War. Give a short description of the most noted battle of this war.
3. Give an account of one important battle near the beginning, and of one near the close of the Revolutionary War.
4. What was the "Stamp Act;" the "Right of Search;" the "Missouri Compromise;" the "Monroe Doctrine?"
5. Of what war was the "Right of Search" one of the leading causes? Describe one of the battles fought during this war.
6. Name three principal causes of the Mexican War, and the leading commanders on each side.
7. Name the principal results of the Civil War. Mention five commanders on each side.
8. Give a short account of the impeachment of President Johnson.
9. What were the Alabama Claims, and how were they settled?

10. Give an account of two important battles fought during the Civil War, with dates.

THEORY AND PRACTICE OF TEACHING.

1. What course would you pursue to keep up with the progress in teaching?
2. When would you begin to teach to children the principles involved in arithmetic? Give reasons for your opinion.
3. What faculties in children do you consider the most important to be developed? Reasons for opinion.
4. How do you succeed in teaching children to spell correctly the common words usually misspelled?
5. What is your method to teach children to discontinue the sing-song, or monotonous tones which many acquire in reading? Is the method original with yourself?
6. What are your methods to insure quiet and order in school?
7. How do you interest lazy and careless pupils? [Answer in full.]
8. Do you think drawing and music should be taught in school? Why?
9. Do you require pupils to prepare their lessons at home, or do you require them to study in school? Why?
10. Explain briefly your method of teaching the difference between a common and a decimal fraction.

ALGEBRA.

1. Divide $a^2+(a-1)x^2+(a-1)x^3+(a-1)x^4-x^5$ by $a-x$.
2. What is the value of a quantity whose exponent is $^{\circ}$? Show that $\dfrac{a^{-2}b^2}{x^{-2}y^3}=\dfrac{b^2x^2}{a^2y^3}$.
3. Write the following quotients: $(x^{2m}-y^{2m})\div(x+y)$, also by $x-y$. $(x^{2m+1}+y^{2m+1})\div(x+y)$, m being an integer.
4. Find the greatest common divisor of $14\,ax-8a+ax^3-7ax^2$ and $16a^2x^2+6a^2x^4-28a^2x^3$.
5. Expand $(x+y)^5$ by the binomial formula.
6. Give the square root of $25a^{\frac{1}{3}}b^2$.
7. Given $\left\{\begin{array}{l} x+\frac{1}{2}y=10-\frac{1}{3}z, \\ \frac{1}{2}(x+z)=9-y, \\ \frac{1}{4}(x-z)=2y-7. \end{array}\right\}$; find the values of x, y, and z.
8. Three masons, A, B, C, are to build a wall. A and B, jointly, can build the wall in 12 days; B and C can build it in 20 days, and A and C in 15 days. How many days would each require to build the wall, and in what time will they finish it if all three work together?
9. A footman travels the first day 20 miles, 23 the second, 26 the third, and so on, increasing the distance each day 3 miles. How many days must he travel at this rate to go 438 miles?
10. Divide the number 27 into two such parts, that their product shall be to the sum of their squares as 20 to 41.

PHYSIOLOGY.

1. Define the terms absorption, secretion, nutrition, and respiration.
2. What gives color to the blood? What parts of the body are not supplied with blood?
3. What are voluntary and involuntary muscles? Give examples. How do the teeth differ from the other bones of the body?
4. State the position and use of the liver. What is the epiglottis, and what is its use?
5. What fluids must be mixed with the food before it can nourish the body? Where are these fluids secreted?
6. Why is more food required in Winter than in Summer? Why should food not be taken too frequently?
7. Describe the mechanism by which the blood is returned to the heart through the veins.
8. By what means is the chest enlarged and contracted in respiration? Name the organs through which the air passes to the blood in the lungs.
9. By what means is animal heat generated and maintained?
10. Name the different vessels that are found in the skin. How may a healthy action of the skin be maintained?

NATURAL PHILOSOPHY.

1. Define specific gravity. Why may heavy stones be lifted in water, when on land they can scarcely be moved?
2. What is *adhesion?* What is *capillary attraction?* Illustrate each.
3. Define *brittle*, *malleable*, and *ductile*. Give two examples each of brittle, malleable, and ductile bodies.
4. Explain the principle of the diving-bell. Give two other illustrations of the same principle.
5. Describe the barometer.
6. Explain the action of the pendulum. What is the principal application of the pendulum?
7. Give the principle of the common pump, and explain its application.
8. Name three ways in which heat can be produced. Give an example of each.
9. What is refraction? Give two illustrations.
10. Describe a galvanic battery.

CONSTITUTION OF THE UNITED STATES.

1. Who becomes President of the Senate in case of the death or removal from office of the President of the United States?
2. Name five powers vested in Congress.
3. How may amendments be added to the Constitution? What is the Thirteenth Amendment?
4. What is the constitutional limit of appropriations by the Legislature of California?
5. Name three personal rights guaranteed by our State Constitution.

SCHOOL LAW OF CALIFORNIA.

1. Who may be admitted to the public schools? Who may be admitted to the State Normal School?
2. State the general powers and duties of the State Board of Education.
3. By whom must the schools be graded? Of what does the Library Fund consist?
4. What certificates may not be renewed by the State Board of Examination? What is required of an applicant for a life diploma? For an educational diploma?
5. When is a school district not entitled to receive any apportionments of the State or county school money?

PENMANSHIP.

1. Which should be taught first: knowledge of form, or command of the pen? Why?
2. Write the small and the capital letters.
3. Can a bad writer teach writing successfully? How?
4. Define an ellipsis. What is the general slant of letters in writing?
5. What three particulars of uniformity should be observed in writing?

NATURAL HISTORY.

1. Describe the parts of a grass-leaf.
2. What is venation, apex, sinus?
3. Write a schedule of a willow-leaf.
4. Describe the principal parts of a flower?
5. Show the difference between a shrub and a tree.
6. Describe the principal divisions of animals.
7. What is the difference between a snake and a worm?
8. To what class does a sponge belong?
9. What is the difference between a whale and a salmon?
10. Give two examples of rodents. What is a rodent?

COMPOSITION.

1. Give two rules for the use of the semicolon, two for the use of the comma, and one for the use of the colon.
2. What do you understand by strength of style? Purity of style? What is a nervous style?
3. What are three important requisites in a composition?
4. What is *metaphor*, *personification*, *simile?*
5. Give the most important rules for the use of capital letters.
6. What is *tautology*, *climax*, *alliteration*, *irony?*
7. (20 Credits.) Write a composition of not less than one page or more than two pages, on one of the following subjects: Modern Poetry;

The Centennial; The Character of American Society; Purity of Thought; The Influence of Forests on the Climate of a Country.

READING.

1. Define articulation, orthoepy, and elocution.
2. Give two rules for emphasis.
3. What is the difference between inflection and modulation?
4. Give the principal rules for good reading.
5. In the following stanza indicate the inflections by the proper signs, and underline the emphatic or accented words:

"Home! how that blessed word thrills the ear!
In it—what recollections blend!
It tells of childhood's scenes so dear,
And speaks—of many a cherished hand."

SPELLING.

1. innuendoes.
2. forest.
3. separate.
4. pavilion.
5. business.
6. religious.
7. cedar.
8. bronchitis.
9. artifices.
10. obeisance.
11. chenille.
12. bayou.
13. intensity.
14. lineal.
15. forfeit.
16. quayage.
17. emigrate.
18. siege.
19. euphonious.
20. expense.
21. imminent.
22. efficacy.
23. accelerate.
24. buffalo.
25. contagion.
26. belligerent.
27. monopolize.
28. isosceles.
29. parallel.
30. consummation.
31. until.
32. Connecticut.
33. Delaware.
34. okra.
35. procrastination.
36. vignette.
37. citadel.
38. infallible.
39. tenacity.
40. amanuensis.
41. transferred.
42. satellite.
43. correspondence.
44. plebeian.
45. intimidate.
46. chalybeate.
47. obliterate.
48. lacerate.
49. aeriform.
50. salamander.
51. feasible.
52. caricature.
53. changeable.
54. edible.
55. interrogation.
56. gregarious.
57. achieving.
58. privilege.
59. separability.
60. lamentable.
61. taciturn.
62. occipital.
63. fuchsia.
64. iniquitous.
65. attenuate.
66. artillery.

67. battalion.
68. queue.
69. eolian.
70. emittent.
71. belladonna.
72. Gaelic.
73. paraffine.
74. paralytic.
75. Viennese.
76. tendinous.
77. chalice.
78. ambulance.
79. cochineal.
80. plebiscitum.
81. intrinsically.
82. chagrin.
83. medullary.
84. septennial.
85. salivation.
86. falcon.
87. cessation.
88. chaotic.
89. ecumenical.
90. acknowledgment.
91. sensory.
92. laminiferous.
93. imagination.
94. hirsute.
95. sibylline.
96. traveler.
97. vestige.
98. willfulness.
99. beginning.
100. agreeable.

WORD ANALYSIS.

1. Analyze and define each of the following: *teacher, befriend, bodily, review, education.*
2. Give the derivation and definition of each of the following words: *creed, incursion, philanthropy, demagogue, literal.*
3. Name five Latin prefixes; add each of them to a primitive word, and define the word so formed.
4. Define *clamor, vigor, thought, tranquil,* and *type.* By the addition of suffixes change the first three words to adjectives, and the last two to verbs.
5. Write sentences containing the following words correctly used: belief, faith, modest, bashful, courage, fortitude.
6. Name five English suffixes; unite each of them to a primitive word, and define the word so formed.
7. Combine and define *crude+ity, busy+ness, pure+ify, medicine+al, school+ar+ly.*
8. Define and explain the formation of *salary, galaxy, calculate, tariff, geometry.*
9. Give the synonym of each of the following words; *incursion, genuine, veracity, ability, lifeless.* Explain the difference between the synonyms should any exist.
10. Define and give the derivation of *corn, heathen, gospel, temporal, astronomy.*

MUSIC.

1. What beats are accented in $\frac{4}{4}$, $\frac{3}{4}$, and $\frac{6}{4}$ time.
2. In a measure of $\frac{4}{2}$ time, what notes are required besides a double-dotted half note?

3. Describe harmony, melody, and discord.

4. In the key of A flat, write on a scale, $\frac{3}{4}$ time, the notes represented by the following numerals: 3– 2 1– 7 6 4 6 5– (a numeral followed by a dash represents a half note).

5. Give an example of a minor second, a major second, a third, and a fifth.

DRAWING.

1. How do horizontal lines appear in perspective?
2. What is meant by the *vanishing point?*
3. Give some examples of right-line figures and simple curves, which you would use as lessons for the several divisions of the third or primary grade.
4. (Ten credits.) Give a freehand outline of a window, desk, or other piece of furniture in the room, as seen from the place where you sit. Pay strict attention to perspective and shading.

[QUESTIONS FOR QUARTERLY EXAMINATION, JUNE, 1875.]

ARITHMETIC.

1. If I buy 2,820 gallons of milk at 4 cents per quart, beer measure, and sell the same at 6 cents per quart, liquid measure, what will be my gain?
2. The longitude of Philadelphia is 75° 10′ west; the difference of time between Philadelphia and St. Louis is 1 hour, 20 seconds; what is the longitude of St. Louis?
3. I wish to divide three fields, one containing 16 acres, the second 20 acres, and the third 24 acres, into lots of equal size. What is the largest number of acres that each can contain?
4. Four men make regular excursions into the country, between which each stays at home one day. The first is always absent 3 days, the second is absent 5 days, and the third and fourth 7 days. If they all start on the same day, how many days must pass before they can all be at home the same day?
5. I bought a horse and a chaise for $250, and paid for the harness seven elevenths of what I paid for the horse. The chaise cost eleven twelfths of the value of the horse. What was the price of each?
6. If a mason is constructing a drain 250.35 feet long, which begins with a width of 8 inches and increases $\frac{5}{10}$ of an inch in every foot of length, how many times the width of the beginning of the drain will its end be?
7. If five compositors in 16 days of 11 hours each, can compose 35 sheets of 24 pages in a sheet, 44 lines on a page, and 40 letters in a line; in how many days of 10 hours each can 9 compositors compose a volume consisting of 36 sheets, 16 pages to a sheet, 50 lines on each page, and 45 letters in a line?
8. I bought a cargo of flour consisting of 560 barrels, at $7 25 per barrel, less 10 per cent; I sold the same at 10 per cent more than $7 25 per barrel. At what per cent above the cost was the flour sold, and what was the gain?

9. There is due to a merchant $800, one sixth of which is to be paid in two months, one third in three months, and the remainder in six months. The debtor agrees to pay one half down. How long may he retain the other half, so that neither party may sustain loss?
10. Four men own a ball of yarn 5 inches in diameter. They agree that each shall wind off an equal share from the ball. How many inches of the diameter will each wind off?

MENTAL ARITHMETIC.

1. If 7 men can perform a certain piece of work in 13 days, in how many days can 21 men do the same work?
2. At 5 shillings per yard, how many yards of cloth can be bought for £2, 12 shillings?
3. How much will a gallon of wine cost, if 7 gills cost 21 cents?
4. The interest on $950 for 5 years, was equal to one third of the principal; how much was the yearly interest?
5. A piece of cloth containing 12 yards was sold for $60, which was four fifths of its cost, how much did it cost, and what was the gain per yard?
6. If one horse eats one bushel of oats in four days, in how many days will six horses eat 48 bushels.
7. Three men hired a pasture for $15; the first put in 4 sheep 5 weeks, the second put in 8 sheep for 5 weeks, and the third put in 10 sheep for 9 weeks. How much must each pay?
8. A man bought a sheep, a cow, and a horse for $70; the cow cost $10 more than the sheep, and the horse cost $20 more than the cow. What was the cost of each?
9. A merchant bought a hogshead of molasses for $20, ten gallons of which leaked out; at how much per gallon must he sell the remainder in order to gain $6 50?
10. What principal will in 4 years, at 5 per cent, amount to $360?

GRAMMAR.

1. Write a complex sentence having two dependent clauses and a prepositional phrase. Let one clause modify the subject and one the predicate of the principal clause.
2. Give the synopsis of the verb *sit*, in the third person singular number. Give the principal parts of *lay*, *set*.
3. Correct the errors in the following sentences, and give the reasons for your corrections:
   (*a*) I lent the book to some one, I know not who.
   (*b*) He is more bold, but not so wise as his companions.
   (*c*) Neither imprudence, credulity, nor vanity, have ever been imputed to him.
   (*d*) The philosopher and poet were banished from the country.
   (*e*) I am going to see my friends in the country, they that we saw last week.

4. Parse the italicised words in the following sentences:

"But *still*, *as* wilder grew the wind,
And as the night grew *drearer*,
Adown the glen rode armed men,
Their trampling sounded nearer."

Child of the sun, refulgent Summer comes.

5. Analyze the following sentence: "The pleasures of sense resemble a foaming torrent, which, after a disorderly course, speedily runs out, and leaves an empty and offensive channel."
6. Construct sentences showing the adjective and participial use of the word *singing*.
7. How does the progressive form of the verb differ from the passive form? Give a synopsis of the verb *eat* in the potential mood, first person, singular number, progressive form.
8. Mention four ways in which the subject or the object of a sentence may be modified. Illustrate.
9. Correct the errors in the following sentences, and give your reasons:
(*a*) Every tree and flower appear with their respective grace.
(*b*) John and James's letters have been received.
(*c*) Those kind of people are very disagreeable.
(*d*) He is the most happy of all the rest.
(*e*) In all his works there is sprightliness and vigor.
10. Name three forms which the independent phrase may assume, and illustrate each.

GEOGRAPHY.

1. Name and describe the two greatest river basins in the world.
2. Name and describe the most important mountain system, the longest river, and locate the largest city in each of the great divisions.
3. Describe the formation of coral islands. To what zone is the growth of such islands chiefly confined?
4. Mention four causes which affect the temperature of a place.
5. Explain the origin, direction, and limits of the trade winds.
6. State by what great commercial routes you can travel around the world, starting from San Francisco.
7. Define Ecliptic and Solstice.
8. What is the cause of the change of seasons, and of the length of day and night?
9. Why does the quantity of rain decrease as we recede from the equator? Why is the quantity less in the interior than on the coast? Why more in mountainous than in level districts?
10. When it is noon in San Francisco, what time is it at a place 70° east of it? 75° west of it?

HISTORY.

1. Name three centennial celebrations that will occur during the year 1875.

2. Mention two facts creditable, and two discreditable, to Benedict Arnold.
3. Give a brief account of General Lee's surrender to General Grant.
4. What events occurred on April 19th, 1775, April 13th, 1861, and April 9th, 1865?
5. Give a brief account of the Alabama and her capture. What important treaty resulted from the depredations of the Alabama?
6. What is the "Tenure of Office Bill?"
7. Describe in full the "Trent Affair."
8. Give a short account of Braddock's defeat.
9. Give an account of what gave rise to the name of "Charter Oak."
10. Mention five particulars in which the progress of the first century of our country is particularly manifested.

THEORY AND PRACTICE OF TEACHING.

1. How may the power of analysis be developed in a child? Why should you aim to develop it?
2. Divide 40,662 by 3 and explain each step. Multiply $\frac{3}{4}$ by $\frac{5}{8}$ and explain.
3. How should the study of composition be introduced in a school?
4. What means would you adopt to prevent "prompting" during recitations and written examinations?
5. What is your opinion of "spelling matches" among scholars as means of elevating the standard of spelling?
6. Give your method of exciting the interest of a class on the subject of geography.
7. Should a written or an oral examination be the final test of a class about to be promoted? Why?
8. Would you teach reading by enforcing rules for inflections, etc., or would you give the greater part of your attention to explanations of the meaning of what is read? Why?
9. To what extent should monitors be employed?
10. When a class is so large that but a small portion of it can use the blackboard at the same time, how would you keep the scholars attentive and interested during a recitation in practical arithmetic?

ALGEBRA.

1. Bought 4 lemons and 7 peaches for 13 cents; 5 oranges and 8 lemons for 44 cents; and 10 peaches and 3 oranges for 20 cents; what was the price of one of each kind?
2. There are two numbers in the proportion of 2 to 3, but if 56 be added to each they will be in the proportion of 32 to 41. What are the numbers?
3. If $x=2$ and $a=12$, what is the value of the fraction $\frac{x^2-ax}{a-x}$?
4. What is the value of x in the equation $x^2-2ax=m^2-a^2$?

5. Divide $\frac{3(x^2-1)}{2(a+b)}$ by $\left(\frac{x+1}{2a}\right)\left(\frac{x-1}{a+b}\right)$.
6. What is the greatest common divisor and the least common multiple of x^2-4a^2, $(x+2a)^3$, and $(x-2a)^2$?
7. The sum of two numbers is 100, the difference of their square roots is 2, what are the numbers?
8. What is the square root of $x^2+a^2b^2+x^2y^2-2abx+2x^2y-2abxy$?
9. What fraction is that, to the numerator of which, if one be added, the fraction will be $\frac{1}{3}$, and if to the denominator one be added, the fraction will be $\frac{1}{4}$?
10. Define the terms equation, reciprocal, zero power, monomial, and quadratics.

PHYSIOLOGY.

1. Is impure blood found in any of the arteries? If so, where? Is pure blood found in any of the veins? If so, where?
2. Why is the image of an object inverted upon the retina? What is the use of the iris; of the crystalline lens; of the cornea; of the aqueous humor?
3. Name the special nerve of sight; of hearing; of taste; of smell. Describe the origin and termination of each.
4. Describe the spinal column and its union with the skull.
5. Describe the situation, use, and arrangement of the salivary, perspiratory, oil, and lachrymal glands.
6. State the names, structure, form, and position of the permanent teeth.
7. Describe the wrist, elbow, shoulder, hip, and knee joints.
8. Name, in order, the different changes which the food undergoes in digestion.
9. What are the objects of circulation? In what vessels is the blood changed from pure to impure; from impure to pure blood?
10. State what you know of the shape, structure, size, strength, and use of tendons.

NATURAL PHILOSOPHY.

1. Why can we, with a tube, suck up water with the mouth?
2. Explain the action of oil in lamp wicks.
3. Explain principle and action of lightning rods.
4. Show that air presses in all directions.
5. Describe the principle on which the barometer is constructed.
6. Give an example of each of the different kinds of lever. Give reasons for your answer.
7. What is the principal application of the pendulum? How is it applied?
8. Give three points of difference between the common and the force pump.
9. What is, and what causes, sound?
10. What causes a black coat to appear black?

CONSTITUTION OF THE UNITED STATES AND OF CALIFORNIA.

1. How many and what departments of government are established under the Constitution of the United States?
2. In which branch of Congress must all bills for raising revenue originate? Bills of impeachment?
3. How many members compose the Assembly of California? The Senate?
4. How and for how long are Assemblymen elected? Senators?
5. Name and describe the branches into which a county government is divided.

SCHOOL LAW.

1. What are the principal duties of the Superintendent of Public Instruction? Of School Superintendents?
2. What are the principal powers and duties of Boards of Trustees?
3. When and how may a new district be formed?
4. How are the School Funds, both State and County, apportioned?
5. What are the principal powers and duties of public school teachers?

PENMANSHIP.

Analyze, according either to the P., D. & S.'s system, or the Spencerian system, first into its principles; second, into its elements:

a; w; g; W; T; O.

2. How would you teach penmanship in an ungraded school?
3. Give three rules for the height, slope, and distance of letters.
4. What movements are used? Which is the most used in business?
5. Write the capitals and small letters. No credits will be allowed unless the elements and principles of the letters are formed correctly.

NATURAL HISTORY.

1. What are the leading characteristics of the articulates? Name two classes belonging to this order.
2. Give the number and names of the classes of vertebrates.
3. Name the order to which each of the following animals belongs, and the portion of the globe it inhabits: Kangaroo, mouse, elephant, whale, tiger.
4. What order of animals chew the cud? Describe the process.
5. In how many orders are birds divided? Which order is most useful to man?
6. What is a cruciferous corolla; a rosaceous corolla; a liliaceous perianth; a campanulate corolla? What do you understand by perianth?

7. What are stem leaves; radical leaves; alternate leaves; opposite leaves; whorled leaves?
8. Name and describe the parts of a seed.
9. What are the principal functions of leaves; of roots?
10. Describe a head; a spike; a raceme; an umbel; a spadix.

COMPOSITION.

[*One credit off for each mistake in spelling, punctuation, construction, or the use of capitals.*]

1. Define the following figures of rhetoric, and give an example of each: Metonymy, vision, apostrophe, antithesis, climax.
2. Explain the following terms: Obscurity, ambiguity, redundancy, pleonasm, tautology.
3. Define the following varieties of poetry, and name poems illustrating each: Epic, pastoral, dramatic, satirical, and elegiac.
4. What is meant by the sublime in writing; by the beautiful? Give quotations illustrating each.
5. Explain the difference between *wit* and *humor*. Name authors distinguished for these qualities.

Write a composition of not less than two pages on one of the following subjects:

1. Young America.
2. Intellectual Excitement.
3. Physical Education.
4. Public Libraries.
5. Magazine Literature.

READING.

1. What do you understand by monotone? Where is it used?
2. What is the difference between accent and emphasis? What is the use of emphasis?
3. What is pitch? What general rules may be given in regard to it?
4. What do you understand by poetic pauses? What is their use? Where do they occur?
5. In the following stanza indicate the poetic pauses and the proper inflections:

"The doves have flown to the sheltering eaves,
And the nests are dark with the drooping leaves;
Twilight gathers and day is done,
How hast thou spent it, restless one?"

SPELLING.

1. enveloped.
2. laudanum.
3. excitable.
4. portemonnaie.
5. empirical.
6. Mediterranean.
7. olfactory.
8. spontaneous.
9. ecstacy.
10. metallurgy.
11. reveille.
12. mucilage.
13. connoisseur.
14. surcingle.
15. Cincinnati.
16. liquefy.
17. crystallized.
18. unparalleled.
19. tyrannical.
20. mahogany.
21. amateur.
22. satellite.
23. gauge.
24. icicle.
25. grandeur.
26. irascible.
27. lettuce.
28. infallible.
29. maxillary.
30. secession.
31. supercilious.
32. retrieve.
33. ineffable.
34. pseudo.
35. viscid.
36. condign.
37. antediluvian.
38. dilemma.
39. indictment.
40. nuisance.
41. diurnal.
42. dentifrice.
43. debilitation.
44. encyclopedia.
45. cutaneous.
46. occurrence.
47. curricle.
48. courier.
49. excruciating.
50. corrollary.
51. cynosure.
52. discrepancy.
53. incremable.
54. cosmography.
55. coruscation.
56. syncope.
57. declarative.
58. mortise.
59. corpuscle.
60. resuscitate.
61. uncivilly.
62. debtor.
63. currier.
64. succinctly.
65. chylification.
66. mullein.
67. courant.
68. surgeon.
69. excessively.
70. chrysanthemum.
71. precedent.
72. incessant.
73. holocaust.
74. cornucopiae.
75. idiosyncrasy.
76. malleable.
77. corpulence.
78. pericardium.
79. recipe.
80. incense.
81. synecdoche.
82. critique.
83. receive.
84. parricide.
85. incidence.
86. civic.
87. orrery.
88. council.
89. receipt.
90. suicide.
91. ebullition.
92. brilliant.
93. symbolize.
94. color.
95. indelible.
96. concomitant.
97. breviary.
98. aviary.
99. embalmer.
100. precipitance.

DEFINING.

1. What is an English primitive word? How is a derivative word formed?
2. Give two English prefixes meaning *one who*, two meaning *to make*, and one meaning the *condition of*. Give an illustration of the use of each.
3. Name a Latin prefix meaning *before*, one meaning *with*, one meaning *against*, one meaning *under*, and one meaning *backwards*. Illustrate the use of each by prefixing it to a primitive word.
4. Give the derivation and definition of *millennium, audible, capital, cordial, thermometer*.
5. Give the synonym of each of the following words: *treasure, excuse, pleasure, mute, enough*.
6. Analyze *renewal, helplessness, boundary, foretaste, dishonorable*.
7. Write sentences containing the following words correctly used: *infirm, imbecile, sincere, genuine, artist*.
8. Give the definition of the following words, and then add a prefix and suffix to each: *teach, alien, incline, fair, construct*.
9. Give the derivation and definition of *corporal, orthodox, cynical, reckless, good-bye*.
10. Analyze and define *animalcule, counteract*. Combine and define *tranquil+ity, celebrate+ion, accompany+ment*.

MUSIC.

1. Why are the first seven numerals or the first seven letters of the alphabet used in music?
2. What accidentals are required for the key of D; key of E flat?
3. Write the music indicated by the following numerals in the key of G, $\frac{3}{2}$ time, a numeral followed by a dash indicating a half note:

   1– | 7, 2, 2—2—1, 3, 3—3—2, 3, 4—6– 6– 5– – || ——
4. What intervals between E & F; B & C; G & B; C & G, and A & F?
5. Define the terms: syncopated notes, staccato, leger lines, cres. and chorus.

DRAWING.

1. What two particulars must be constantly kept in view in drawing?
2. Draw a simple figure having the different angles used in drawing.
3. What are construction lines? Illustrate their use by drawing a figure requiring construction lines.
4. What is perspective drawing? How do horizontal lines appear in perspective?
5. Draw some object illustrating perspective. No credits to be given unless the perspective is shown.

[QUESTIONS FOR QUARTERLY EXAMINATION, SEPTEMBER, 1875.]

ARITHMETIC.

1. If a capitalist invests $10,000 in U. S. 5-20s at 125, what is the currency value of the annual income from the investment when gold is 115?
2. (*a*) Prove that multiplying the numerator of a fraction multiplies the value, and multiplying the denominator divides the value of the fraction.

   (*b*) Reduce 20 to a fraction whose denominator is 4.

   (*c*) Add $\frac{2}{3}$ and $\frac{2}{6}$. Explain in full.

   (*d*) From 1 take .04.

   (*e*) What is the product of $.6 \times .6$?
3. (*a*) By what measure, weight, or count, is the price of each of the following articles quoted in the market reports: *Flour, Hay, Wheat, Lumber, Eggs, Brick, Packed Meats, Cotton, Oils, Wood?*

   (*b*) Under date of Sept. 1, 1875, make out John Smith's bill against William Brown, for the following groceries, bought July 1, 1875, 30 days, 10 per cent interest after account matured: 10 lbs. coffee, @ 29 cents; 3 lbs. tea, 1 lb. @ $1, 2 lbs. @ $1 25; 2 gallons vinegar, @ 45 cents; 5½ bushels of apples, @ 75 cents; 25 lbs. sugar, @ 13 cents; 1 barrel extra mess beef, $13; 7 lbs. prunes, @ 18¾ cents; 1 barrel mackerel, No. 1, $23; 33⅓ lbs. bacon, @ 9⅓ cents. Brown paid $20 on account when purchasing the goods.
4. What will it cost to color the walls and ceiling of a room 44 feet long, 20 feet wide, 14 feet high, at 85 cents per 100 square feet?
5. A speculator bought 320 acres of land at $16 37½ per acre, and after keeping it a year sold it for $6,172 72; how much greater per cent did he realize than he would have realized by lending his money at 10 per cent?
6. At $1 50 a rod for fencing, what will it cost to inclose a square field containing 40 acres, and to run the cross fences necessary to divide it into 9 equal square lots? (Draw diagram.)
7. If 120 men, working 78 days, 10 hours a day, can make 9,448 yards of cloth, how many *more* yards can 300 men make in 312 days, working 10 hours and 10 minutes a day?
8. (*a*) Show why a difference of one degree of longitude causes a difference of four minutes in time.

   (*b*) Give the longitude of a certain place in which the sun rises 12 hours and 50 minutes earlier than in San Francisco, 122° 39′ West being the longitude of San Francisco.
9. (*a*) Define *Prime Factor, Root, Ratio, Diameter, Exchange.*

   (*b*) Analyze fully: If $7¾ pay for 2⅔ yards of cloth, how many yards can be bought for $4⅝?
10. A commission merchant who buys produce at 2¾ per cent commission, receives $1,350 20 with which to purchase beef; how many barrels can he buy at $9 37½ per barrel? How much is his commission? Full analysis.

MENTAL ARITHMETIC.

1. A ship has sailed 24 miles in 4 hours; how many hours will it take her to sail 150 miles?

2. How many times are $\frac{3}{7}$ contained in $\frac{2}{3}$?

3. What number is that which being increased by its half, its fourth, and 18 added, will be doubled?

4. A man built 20 rods of wall in a certain time; another man can build 10 rods while the first builds $3\frac{1}{3}$; how much could the second man have built while the first man built the 20 rods?

5. If John can do a piece of work in 2 days, and James can do it in 4 days, how long will it take both of them together to do it?

6. If \$40 worth of provisions will serve 10 men 12 days, how many days will \$50 worth of provisions serve 15 men?

7. A man bought 20 pears at the rate of two for three cents; how much did they come to?

8. 20 is 5 per cent of what number?

9. A can do a piece of work in 3 days, B in 9 days, and C in 12 days; how long will it take all three of them to do it together?

10. If it takes 1 yard and $\frac{2}{7}$ of a yard of cloth to make a pair of pantaloons, and 3 yards and $\frac{5}{7}$ of a yard to make a coat, how many yards of cloth will it take to make five pairs of pantaloons and five coats?

GRAMMAR.

1. Write a sentence containing an adjective phrase; one containing an adverbial clause; one containing a subject phrase; one containing an object clause.

2. Give two rules for determining the number and person of a verb when the subjects are connected by *or* or *nor*.

3. When several possessives are connected, to how many of them must the sign of possession be annexed? Illustrate in two ways.

4. Name three ways in which a noun may be independent. Give an example of each.

5. Explain the difference between a participle and a participle adjective. Give in a sentence an example of each.

6. Write a complex interrogative sentence. What is the difference between *later* and *latter;* between *rise* and *raise?*

7. Analyze:

"Around them rise, in pristine chaos hurled,
The ancient rocks, the secrets of the world."

8. In the following sentences parse the italicized words:

"I dare *do* all that may become a *man;*
Who dares do more *is none.*"
"He sailed *north* a hundred *miles* the first *day.*"
My *friend* having gone, I am *alone.*

9. Correct the following sentences, giving the reasons for correction:

(*a*) Peace of mind is easier lost than gained.
(*b*) His brothers offense is not his.
(*c*) The work has been finished last week.
(*d*) He laid down to rest.
(*e*) There remain two points to be settled.

10. When are the parts of a compound word separated by a hyphen? What classes of adjectives are not compared? What verbs are followed by an adjective? When? Write a sentence containing the verb *sit* in the future perfect tense; one containing *set* in the same tense.

GEOGRAPHY.

1. Locate the following, and tell for what each is distinguished: *Hecla, Halifax, Clyde, Columbia, Magellan.*.

2. Beginning at the north, name the waters which surround and penetrate the coast of Europe.

3. Name and locate the highest two mountain ranges in each grand division of the earth.

4. Name the States that are drained to any extent by the Ohio River.

5. Name and locate the chief city of each State which has an Atlantic seaport, naming also the seaport.

6. Name and locate the principal countries with which San Francisco trades, naming the articles, and stating whether exported or imported.

7. Trace a water route from Sacramento to the largest city of Europe.

8. Name the country producing most silk; most wine; most tea; most coal; most valuable timber.

9. Name and locate the capitals of the countries of Europe.

10. Give the boundaries and width in degrees of each zone. Whence result the zones?

HISTORY OF THE UNITED STATES.

1. Name three Spanish settlements in America; three English settlements; three French settlements; one Swedish settlement.

2. Name five colonies that were settled on account of religious persecution. State where and by whom each was settled.

3. What was the Boston Port Bill? Why was it passed?

4. Give an account of Nullification in South Carolina. How was the difficulty settled?

5. Give an account of President Jackson's and President Tyler's action regarding the United States Bank.

6. What were the causes of the Mexican War? How long did it last? During whose administration did it occur? Give the terms of the treaty by which it was ended.

7. Name the States that passed the ordinance of secession.

8. Give a short statement of the action of England during the War of Secession; of France; of Russia.

9 What difficulties have arisen between the United States and England, France, and Spain, since 1789?

10. Name four inventions of great importance that have been made by Americans during the past century. Name three of the greatest American statesmen; three of the most celebrated American authors.

THEORY AND PRACTICE OF TEACHING.

1. What is the difference between education and learning? Between education and instruction?

2. Enumerate the more important duties to be performed on the first day of school.

3. In organizing your school, what provision would you make for securing order? Neatness? Industry?

4. Mention some of the means by which teachers may injure the sensibilities of children.

5. In what manner would you make use of cards, charts, pictures, and objects in teaching primary reading, and for what purpose?

6. Give an outline of a course of lessons in number for a primary school.

7. Name some of the more important advantages of natural history as a study for children, when properly taught?

8. How would you stimulate your pupils to study thoroughly the subject matter of a reading lesson?

9. Give an outline of a course in language and grammar adapted to a first grade or grammar school.

10. In what way would you cultivate self-reliance in pupils?

ALGEBRA.

1. Define the terms of an algebraic quantity; similar terms; residual; reduction of an equation; exponent.

2. From $8a^2c-14aby+7a^2b^2$ take $9a^2c-14aby+15a^2b^2$, and explain the operation.

3. Simplify the fraction $\dfrac{\dfrac{m^2}{m^2-n^2}-1}{\dfrac{n^2}{m^2-n^2}+1}$.

4. What is the least common multiple of m^2-4, $zm-2z$, and m^2+2m? Find the greatest common divisor of $3a^2b-9a^2c-18a^2mz$, and $b^2c-3bc^2-6bcmz$.

5. Of a detachment of soldiers, $\frac{2}{3}$ are on actual duty, $\frac{1}{8}$ are sick, $\frac{1}{5}$ of the remainder absent on leave, and the rest, which is 380, have deserted. What was the number of men in the detachment?

6. What fraction is that whose numerator being doubled, and its denominator increased by 7, its value becomes $\frac{2}{3}$; but the denominator being doubled, and the numerator increased by 2, the value becomes $\frac{3}{5}$?

7. What is the square root of $a^6-6a^5c-15a^4c^2-20a^3c^2+15a^2c^4-6ac^5+c^6$?

8. The difference of two numbers is 6, and the sum of their squares is 50. What are the numbers?

9. Prove that any quantity having a negative exponent is equal to the reciprocal of that quantity with an equal positive exponent.

10. A carpenter agreed to live with a farmer during the Winter, on the condition that for every day he worked he should receive $1 50, and for every day he was idle he should forfeit 65 cents. At the expiration of 129 days they settled, and the carpenter received nothing. How many days did he work, and how many was he idle?

PHYSIOLOGY.

1. Describe the skull. In which portion of it is the most important part of the brain placed? Why?

2. What is the diaphragm? Describe it.

3. Why are some of the muscles voluntary and others involuntary in their action?

4. Describe the stomach. What change does the food undergo while in the stomach?

5. Mention some of the conditions which tend to promote the most perfect digestion.

6. Name the respiratory organs. Describe the lungs.

7. Describe the larynx. What are the principal agents in the formation of sounds?

8. What is the cause of stammering? How may it be cured?

9. Describe the cuticle and cutis vera. Give two reasons why frequent bathing is necessary.

10. Of what does the lachrymal apparatus consist? Describe the nasal duct.

NATURAL PHILOSOPHY.

1. What are the principles of the electric telegraph?

2. What is dispersion of light? How can it be shown?

3. What is a self-luminous body? Mention three self-luminous bodies.

4. What is ventilation? Is it sufficient for the ventilation of a room to simply admit fresh air?

5. Why does heated air rise? Prove that the air of a room is warmer near the ceiling than near the floor.

6. What is the universal effect of heat upon bodies?

7. When does it rain? Why does it rain in mountainous countries more than in low lands?

8. When is the breath visible?

9. Give examples of brittle, malleable, and ductile bodies.

10. Why may heavy stones be lifted in water, while on dry land they can scarcely be moved?

CONSTITUTION OF THE UNITED STATES AND OF CALIFORNIA.

1. What persons are eligible to the office of United States Representative?

2. By what process can a bill of Congress become a law?

3. How may amendments be added to the Constitution of the United States?

4. In whom is the judicial power of California vested?

5. Name three powers of the Governor of the State.

SCHOOL LAW.

1. Name five powers and duties of the State Board of Education.

2. What persons are eligible to the office of School Superintendent?
3. Who may be admitted to public schools?
4. Of what does the District Library Fund consist?
5. To whom may life diplomas be issued? To whom may educational diplomas be issued?

PENMANSHIP.

[*Applicants may answer according to either the P., D. & S. System or the Spencerian System.*]

1. Write the small letters in groups, arranged according to height.
2. Name three particulars to be observed in writing words.
3. Give a rule for the height of letters; one for spacing.
4. Describe the elements used in writing.
5. Describe the principles used.

NATURAL HISTORY.

1. What are vertebrates? Name two of each kind of vertebrates.
2. Describe a mollusk. Name some of the principal mollusks found in the United States.
3. Name the order to which each of the following animals belong, and the portion of the globe it inhabits: giraffe, emir, crocodile, whale, and beaver.
4. What is the difference between a horse and a pig? Between a pig and an ox?
5. Into what orders are birds divided? Which order is the most useful to man?
6. Describe sepal, petal, perianth, stamen, pistil.
7. What are stem leaves? radical leaves? alternate leaves? opposite leaves? whorled leaves?
8. Name and describe the parts of a seed.
9. What are the principal functions of leaves? of roots? of the bark?
10. What is the difference between an apple tree and a palm tree?

COMPOSITION.

1. Name and define figures of speech.
2. Explain the following terms: obscurity, ambiguity, redundancy, pleonasm, tautology.
3. Name five requisites for clearness of style.
4. Explain the difference between *wit* and *humor*. Name authors distinguished for these qualities.
5. What is meant by the sublime in writing? by the beautiful? Give short quotations illustrating each. Write a composition of not less than one page on one of the following subjects:

Influence of Education.
Intellectual Excitements.
Patriotism.
Physical Education.
Progression in Teaching.

READING.

1. What faults produce inarticulate reading?
2. What faults produce monotonous reading?
3. What is meant by good elocution?
4. What position of the body must be assumed in reading?
5. What is the difference between enunciation and articulation?
6. What is scanning?
7. What are the advantages of concert reading?
8. What are its disadvantages?
9. What is inflection?
10. What is modulation?

(Twenty-five credits the maximum for oral exercises)

SPELLING.

1. Periphery.	28. Lymphatic.
2. Crucible.	29. Temperature.
3. Bullion.	30. Collegiate.
4. Pyrites.	31. Judicious.
5. Pumice.	32. Alleghany.
6. Stereotype.	33. Tuolumne.
7. Gyration.	34. Suisun.
8. Hemorrhage.	35. Deficiency.
9. Parasite.	36. Enveloped.
10. Symphony.	37. Diaphragm.
11. Eccentric.	38. Tortoise.
12. Lachrymose.	39. Excessive.
13. Saccharine.	40. Seized.
14. Auxiliary.	41. Avaricious.
15. Crochet.	42. Financial.
16. Piazza.	43. Laudanum.
17. Lucretia.	44. Emphasis.
18. February.	45. Yacht.
19. Shrieked.	46. Transient.
20. Criticize.	47. Specie.
21. Caoutchouc.	48. Demeanor.
22. Phlegm.	49. Essential.
23. Vicissitude.	50. Necessary.
24. Gorgeous.	51. Neutralize.
25. Premature.	52. Mechanism.
26. Oxygen.	53. Peculiar.
27. Capillary.	54. Hemisphere.

55. Familiar.
56. Symptoms.
57. Conscious.
58. Reigning.
59. Elixir.
60. Chivalry.
61. Licorice.
62. Syllogism.
63. Hypocrite.
64. Synthesis.
65. Tyrannize.
66. Hosiery.
67. Solecism.
68. Frontispiece.
69. Logarithms.
70. Obsequies.
71. Eucharist.
72. Eulogize.
73. Scurrilous.
74. Rheumatism.
75. Escutcheon.
76. Sovereign.
77. Honeycomb.
78. Perquisite.
79. Servilely.
80. Courtesy.
81. Cynosure.
82. Synedoche.
83. Nuisance.
84. Gauge.
85. Surcingle.
86. Ecstacy.
87. Precedent.
88. President.
89. Orrery.
90. Curricle.
91. Satellite.
92. Mediterranean.
93. Mortise.
94. Recipe.
95. Parricide.
96. Malleable.
97. Dentifrice.
98. Excruciating.
99. Unparalleled.
100. Corollary.

DEFINING.

1. What is word analysis? What is a Latin primitive word?
2. Add to the word *satire* a suffix making it a verb; one making it a noun; one making it an adjective. Which of these suffixes are Latin and which English?
3. Name an English prefix meaning *on* or *in;* one meaning *to make;* two meaning *not;* one meaning *wrong* or *wrongly.* Illustrate the use of each.
4. Analyze and define *only, creative, dishonorably, inexpressible, scepticism.*
5. Combine and define *nation+al+ity, commerce+ial, benign+ity, un+educate+ed, un+health+y.*

MUSIC.

1. What effect is produced by placing two dots after a note?
2. Between what numbers do the semitones occur in the major scale? In the minor scale?
3. Give the signatures of the following scales: F, G, and D.
4. What is the use of a sharp? A flat? A natural?
5. Name the different kinds of time.
6. What sign is used to denote accent? To denote repetition?
7. Name the different kinds of rests. Give an example of each.
8. Define the following terms: Allegro; andante; crescendo; staccato.
9. What is the use of the bar? The double bar?
10. What is the trill? The turn?

DRAWING.

1. What two particulars must be constantly kept in view in drawing?
2. Draw a simple figure having the different angles used in drawing.
3. What are construction lines? Illustrate their use by drawing a figure requiring construction lines.
4. What is "perspective drawing?" How do horizontal lines appear in perspective?
5. Give a drawing illustrating perspective. No credits to be given unless the perspective is shown.

LIST OF HOLDERS OF STATE CERTIFICATES AND DIPLOMAS,

In full force and effect November 1st, 1875.

Life Diplomas.

Name.	When issued.
Abbot, Warren	November 11, 1871.
Allen, L. D	November 11, 1871.
Allsopp, J. P. C	November 25, 1869.
Ames, Charles G	November 25, 1869.
Anderson, J. W	December 15, 1868.
Anderson, Mrs. C. A	November 28, 1873.
Atwood, Mrs. C. L	November 29, 1867.
Austin, Miss Minnie F	December 27, 1866.
Bagnall, John	November 29, 1867.
Bailey, C. P	December 15, 1868.
Baker, George F	June 21, 1873.
Baldwin, Miss Nellie	January 5, 1875.
Barr, Miss Sara A	November 28, 1873.
Batchelder, H. T	November 28, 1873.
Beals, Mrs. C. R	June 3, 1872.
Benjamin, C. V	June 3, 1872.
Bennett, Miss Mary H	June 22, 1874.
Bernard, Miss A. S	January 5, 1875.
Black, Samuel T	December 13, 1872.
Blake, Charles M	June 22, 1874.
Bodwell, Miss Mary L	December 27, 1866.
Bolander, H. N	December 15, 1868.
Bradley, Theodore	December 27, 1866.
Braly, John H	November 25, 1869.
Brodt, A. W	March 14, 1871.
Brown, George	December 27, 1866.
Brown, F. R	July 5, 1867.
Brown, Miss S. L	June 22, 1874.
Buckman, F. S. S	June 1, 1875.
Bunnell, George W	December 27, 1866.
Burke, Lizzie K	November 28, 1873.
Campbell, Miss C. C	December 13, 1872.
Campbell, F. A	November 28, 1873.
Carlton, H. P	June 8, 1866.
Casebolt, Miss M. A	June 3, 1872.

Name.	When issued.
Castelhun, Miss Maria A	June 22, 1874.
Chalmers, Miss Annie B	January 5, 1875.
Chapman, M. V	June 3, 1872.
Chestnutwood, Jno. A	February 17, 1873.
Childs, C. W	May 27, 1868.
Clapp, Mrs. L. K	December 15, 1868.
Clark, Dorcas	November 29, 1867.
Clark, Mary E	November 29, 1867.
Clark, Miss H. M	December 27, 1866.
Clark, L. R	July 12, 1870.
Clark, M. C	June 1, 1875.
Cleveland, Miss E. A	June 3, 1873.
Coe, Eli G	March 14, 1871.
Conklin, E. B	March 14, 1871.
Cook, Mrs. P	March 9, 1870.
Cook, Miss Hannah	November 28, 1873.
Cottle, Melville	May 21, 1869.
Craven, Andrew F	June 22, 1874.
Crawford, Mrs. J. F	June 22, 1874.
Cross, C. W	January 5, 1875.
Crowhurst, Wm	June 1, 1875.
Crowell, C. H	February 17, 1873.
Cummings, C. C	December 27, 1866.
D'Arcy, Miss M. E	December 13, 1872.
Davis, Mrs. Imogene W	January 5, 1875.
Deane, Mrs. M	June 13, 1871.
Deetkin, Mrs. Lizzie G	June 22, 1874.
Denman, James	December 27, 1866.
Dodge, W. C	June 22, 1874.
Dooner, John	January 5, 1875.
Drake, A. J	March 14, 1871.
Duane, Mrs. A. S	June 3, 1872.
DuBois, Mrs. A. E	December 15, 1868.
Eickhoff, J. Henry	November 28, 1873.
Farley, A. J	December 13, 1872.
Field, Miss Carrie P	June 1, 1875.
Finch, J. B	November 11, 1871.
Fitzgerald, A. L	November 11, 1871.
Foster, Mrs. J. A	November 28, 1873.
Foster, Mrs. Emily	June 22, 1874.
Fowler, Miss Laura T	December 15, 1868.
Freman, G. N	January 5, 1875.
Fry, W. H	December 13, 1872.
Fuller, A. L	November 25, 1869.
Furlong, N. (revoked 1873)	June 13, 1871.

Life Diplomas—Continued.

Name.	When issued.
Gates, Freman	December 13, 1872.
Gabriel, Mrs. C. E	June 22, 1874.
Gorman, W. J	February 17, 1873.
Goodrich, A. H	June 20, 1868.
Graf, Miss Minnie	December 13, 1872.
Granger, W. N	May 2, 1868.
Grant, Miss Ella G	January 5, 1875.
Grant, Miss Helen A	June 1, 1875.
Gray, Jno. C	May 21, 1869.
Greer, Miss Jane E	June 1, 1875.
Griffith, Mrs. Aurelia	March 14, 1871.
Gunn, Miss S. M.	June 1, 1875.
Gwinn, James M	November 11, 1871.
Hamilton, Miss Addie	November 28, 1873.
Hammond, Josiah Shaw	November 28, 1873.
Harlon, James	September 24, 1867.
Hart, W. C	February 17, 1873.
Henning, Irving P	June 1, 1875.
Herbst, A	February 17, 1873.
Higby, H. C	June 1, 1875.
Hill, Miss A. H	February 17, 1873.
Hill, Whitman H	March 14, 1871.
Hodgdon, Miss S. J	December 13, 1872.
Hoffman, Mrs. Mary L	November 28, 1873.
Hoitt, Ira G	December 27, 1866.
Holbrook, T. W. J	December 27, 1866.
Holder, W. W	November 11, 1871.
Holmes, Ahira	December 27, 1866.
Holmes, Ellis H	December 27, 1866.
Houghton, Miss E. W	December 27, 1866.
Howe, H. H	May 27, 1868.
Howe, J. M	September 24, 1867.
Howe, Converse	June 1, 1875.
Hucks, Annie E	January 5, 1875.
Hudson, J. A	February 17, 1873.
Humphrey, E. D	May 27, 1868.
Humphreys, Miss L. A	June 22, 1874.
Humphreys, Miss M. A	June 22, 1874.
Hunt, Miss Carrie L	March 9, 1870.
Hurley, Miss J. M. A	November 28, 1873.
Hutton, Chas. E	November 28, 1873.
Itsell, A. J	June 22, 1874.
Jackman, Samuel H	May 9, 1870.
Jessup, Miss S. A	December 13, 1872.
Jewett, Miss Susan N	June 3, 1872.

Life Diplomas—Continued.

Name.	When issued.
Johns, Charles T	November 11, 1871.
Johnson, J. G	March 9, 1870.
Jones, George W	November 11, 1871.
Kennedy, Kate	November 29, 1867.
Kennedy, J. G	November 11, 1871.
Kennedy, W. W	November 11, 1871.
Kercheval, Miss Jennie G	November 25, 1869.
Kinne, H. C	June 3, 1872.
Kirkpatrick, J. M	November 25, 1869.
Knowlton, Ebenezer	December 27, 1866.
Lamb, Miss Irene	November 28, 1873.
Leadbetter, W. R	July 12, 1870.
Leggett, Joseph	June 3, 1872.
Leonard, T. C	December 27, 1866.
Levinson, Miss Rosa	June 3, 1872.
Levy, Daniel	November 28, 1873.
Lighthall, G. E	March 14, 1871.
Littlefield, J. D	December 27, 1866.
Loomis, Miss Amanda	December 15, 1868.
Lovett, C. M	January 5, 1875.
Lubeck, Mrs. Julia M	January 5, 1875.
Lucky, W. T	November 29, 1867.
Lynch, Miss Frances	December 27, 1866.
Mack, George C	December 27, 1866.
Mackall, J. N	December 13, 1872.
Makinney, H. E	December 15, 1868.
Mann, Azro L	November 29, 1867.
Manning, Miss Agnes M	November 28, 1873.
Marks, Bernhard	June 8, 1866.
Marriner, R. K	December 27, 1866.
Marsh, Mrs. S. W	June 13, 1871.
McBride, H. E	January 5, 1875.
McCarty, A. F	January 5, 1875.
McChesney, J. B	July 5, 1867.
McDonald, A. H	December 15, 1868.
McDonald, Mrs. A. H	January 5, 1875.
McDonald, W. P	January 5, 1875.
McFadden, Miss Agnes	January 5, 1875.
McFadden, W. M	March 14, 1871.
Menefee, C. A	November 11, 1871.
Metzger, C. L	January 5, 1875.
Middleton, Mrs. Eliza F	June 1, 1875.
Miller, Miss Ora E	November 28, 1873.
Millette, Percival C	March 14, 1871.
Milliken, Mrs. Ellen A	November 28, 1873.

Life Diplomas—Continued.

Name.	When issued.
Minns, George W	June 8, 1866.
Moore, John A	March 14, 1871.
Morgan, Mrs. L. A	December 13, 1872.
Morrill, Joseph C	September 24, 1867.
Morris, George F	September 24, 1867.
Morris, N. Z	November 28, 1873.
Morse, Augustus, Jr	November 29, 1867.
Murphy, Miss Mary M	June 1, 1875.
Myrick, Thomas S	December 27, 1866.
Nelson, Henry A	March 14, 1871.
Nicholson, Thomas	June 22, 1874.
Nutting, H. N	December 27, 1866.
O'Connor, Joseph	March 14, 1871.
O'Dwyer, James	June 22, 1875.
Olinger, A. F	December 13, 1872.
Otis, James	November 28, 1873.
Overend, Miss Lizzie	November 28, 1873.
Parker, Miss Jean	March 14, 1871.
Pascoe, Miss Mary I	June 3, 1872.
Peck, George H	June 1, 1875.
Pelton, John C	December 27, 1866.
Penwell, S. A	June 20, 1868.
Phelps, Mrs. M. W	June 22, 1874.
Potter, M. B	March 14, 1871.
Powell, Miss Elizabeth	June 1, 1875.
Power, Frank	November 11, 1871.
Prescott, Miss D. S	March 14, 1871.
Preston, E. M	May 21, 1869.
Price, Caroline	November 29, 1867.
Prior, Philip	March 14, 1871.
Randall, A. H	June 19, 1868.
Rattan, Volney	June 22, 1874.
Reed, L. W	July 12, 1870.
Reynolds, Mrs. F. E	December 13, 1872.
Rose, T. H	June 20, 1868.
Rousseau, E	May 21, 1869.
Rowe, Miss A. A	February 17, 1873.
Rowell, W. K	December 27, 1866.
Sanders, W. A	May 21, 1869.
Sankey, M. J	January 5, 1875.
Schellhous, E. J	May 21, 1869.
Shaw, Miss E. A	June 3, 1872.
Shearer, S. M	December 13, 1872.

Life Diplomas—Continued.

Name.	When issued.
Shearer, Mrs. C. O	November 28, 1873.
Sherman, Fannie M	June 1, 1875.
Shipley, J. C	November 28, 1873.
Short, Miss Julia B	June 1, 1875.
Sibley, J. M	December 27, 1866.
Simon, Miss Frances	December 13, 1872.
Simonton, George W	December 27, 1866.
Slavan, Miss A. E	June 3, 1872.
Smith, Miss Annie	May 27, 1868.
Smith, Miss Carrie L	December 13, 1872.
Smith, Miss Jennie	June 3, 1872.
Smith, W. A. C	June 19, 1868.
Smith, Miss Jennie	June 22, 1874.
Southworth, Mrs. E. A	December 15, 1868.
Standeford, Mrs. N. D	June 1, 1875.
Steel, Thomas H	January 5, 1875.
Stevens, Stephen C. (revoked 1873)	March 14, 1871.
Stincen, Miss Alice M	November 28, 1873.
Stone, H. P	March 14, 1871.
Stone, D. C	December 27, 1866.
Stone, Mrs. B. H	November 28, 1873.
Stowell, Fannie A	June 22, 1874.
Stowell, Miss M. E	June 3, 1872.
Stowell, Miss P. M	June 3, 1872.
Stratton, James	December 27, 1866.
Sullivan, Miss Kate	June 3, 1872.
Sumner, J. H	November 28, 1873.
Swett, John	September 24, 1867.
Swett, Mrs. Mary L	December 27, 1866.
Swezey, S. I. C	November 29, 1867.
Tait, George	December 27, 1866.
Taylor, Robert	December 27, 1866.
Temple, Miss Emma	November ——.
Templeton, Miss L. S	December 13, 1872.
Templeton, M. L	November 29, 1867.
Thompson, Miss Helen	June 3, 1872.
Thurber, A	November 11, 1871.
Thurston, E. T	May 21, 1869.
Trafton, Dr. A	November 11, 1871.
Upham, Isaac	May 21, 1869.
Walsh, Miss Nellie E	June 1, 1875.
Warren, C. G	November 25, 1869.
Warren, R. B	July 12, 1870.

Life Diplomas—Continued.

Name.	When issued.
Waterman, S. D	November 11, 1871.
Watson, Mrs. C. R	December 13, 1872.
Watson, Miss Mary J	June 3, 1872.
Watkins, Emory	January 5, 1875.
Watson, B. J	June 1, 1875.
Watson, Miss Lizzie J	June 22, 1874.
Weir, Miss Sarah J	December 15, 1868.
Wells, Mrs. Laura H	March 14, 1871.
Wermuth, Hamilton	March 14, 1871.
Wheelock, Mrs. D. B	November 28, 1873.
White, Silas A	November 11, 1871.
White, T. B	December 13, 1872.
White, William	June 20, 1868.
White, Miss Louisa E	January 5, 1875.
Williams, W. J. G	November 25, 1869.
Wilson, H. R	March 14, 1871.
Wilson, Jas. K	June 1, 1875.
Wood, Mrs. E. A	June 3, 1872.
Woodruff, Miss Frances A	July 12, 1870.
Woodworth, Mrs. Janette E	June 1, 1875.
Yates, W. A	June 22, 1874.

Educational Diplomas.

Name.	Expires.
Ables, Thomas J	June 27, 1880.
Adams, W. J	January 20, 1879.
Aldrich, Abbie F	April 6, 1878.
Alderson, Miss M. J	May 17, 1881.
Alexander, Mary J	August 29, 1880.
Ames, Martha	May 13, 1879.
Anderson, C. A	July 9, 1876.
Ashbrook, M. V	July 16, 1876.
Ashbrook, T. P	June 13, 1877.
Ashley, Miss Julia V	February 11, 1879.
Ashton, Mrs. N. Jennie	March 22, 1881.
Ayers, Mary J	March 22, 1881.
Babcock, William S	January 4, 1881.
Baker, Samuel D	August 28, 1881.

Educational Diplomas—Continued.

Name.	Expires.
Banks, Jerome	July 10, 1878.
Barbour, Aron C	December 5, 1880.
Barnard, Miss Abbie S	February 3, 1878.
Barthelow, Mrs. A. W	April 15, 1877.
Beck, Mrs. N. B	June 5, 1880.
Bennett, Miss Mary H	January 20, 1879.
Betancue, Miss Lizzie	December 13, 1879.
Biggs, Thomas	June 27, 1880.
Bightmire, S. A	September 22, 1881.
Bissell, Joseph	August 30, 1879.
Bloomer, A. C	November 7, 1880.
Boardman, C. F	November 13, 1875.
Bolton, Miss H	October 4, 1877.
Bonnard, Miss Eureka A	May 17, 1881.
Boynton, Miss Kate	May 31, 1881.
Bragg, Miss M. J	February 19, 1880.
Breschen, Seraphine	July 18, 1880.
Brier, K. W	September 30, 1877.
Brigham, Miss Fannie E	July 10, 1878.
Brigham, Miss Julia P	October 22, 1876.
Brophy, M	June 16, 1877.
Brophy, M	May 22, 1880.
Brown, A. G	August 27, 1876.
Brown, Miss J. B	March 22, 1879.
Brown, Sarah E	April 8, 1877.
Brown, J. B	January 10, 1880.
Brown, George J	December 5, 1880.
Brumsley, Miss M. I	April 10, 1881.
Bryant, Miss Annie	March 22, 1879.
Buckman, F. S. S	April 6, 1878.
Bugby, Mrs. B. N	March 24, 1880.
Bunnell, Mrs. Alice	April 6, 1878.
Burke, Lizzie	November 27, 1878.
Bush, Mrs. E. A	September 22, 1881.
Campbell, Amy T	March 13, 1881.
Carr, Ezra	September 16, 1876.
Case, E. L	May 22, 1880.
Castelhun, Miss Mary A	October 8, 1876.
Chalmers, Miss Annie B	May 27, 1877.
Chase, Miss Carrie M	November 25, 1877.
Chesnutwood, Mrs. J. A	July 22, 1879.
Ciprico, Miss Anita C	February 8, 1881.
Clark, M. C	March 5, 1876.
Clark, W. J	July 10, 1878.
Clay, William T	January 13, 1877.
Connolly, J. J	June 16, 1877.
Cooke, Miss Hannah	May 27, 1877.

Educational *Diplomas*—Continued.

Name.	Expires.
Cooper, Mrs. F. A	August 7, 1881.
Cory, Miss A. A	April 10, 1881.
Coulter, Leonard	October 15, 1876.
Crane, Miss Amanda	September 22, 1881.
Crane, George	November 7, 1880.
Craven, Andrew F	July 10, 1878.
Crawford, T. O	July 9, 1877.
Crocker, Miss L. H	July 10, 1878.
Cross, C. W	December 13, 1879.
Crothers, Marg. I	December 5, 1880.
Crowhurst, William	November 9, 1876.
Culbertson, Mary K	February 3, 1878.
Curragh, J. M	July 18, 1880.
Daniels, Mrs. S. B	October 5, 1878.
Davidson, Mrs. Nannie S	September 22, 1881.
Davis, Mrs. Imogene	May 13, 1879.
Davis, J. T	June 13, 1877.
Davis, Miss Sadie	January 21, 1877.
De Nure, D. D	May 31, 1881.
Dolliver, Miss Clara G	October 28, 1877.
Dooner, John	January 13, 1877.
Doud, Miss Nettie	July 10, 1875.
Doyle, Mrs. James A	December 13, 1879.
Dozier, A. W	October 5, 1878.
Dozier, Melville	April 20, 1878.
Drake, Charles Milton	September 22, 1881.
Du Bois, John B	June 27, 1880.
Duenkel, William	July 18, 1880.
Dunbar, Annie S	January 10, 1880.
Dunbar, S. G. S	October 4, 1877.
Dyer, James O	November 11, 1877.
Edwards, W. H	February 8, 1881.
Eickhoff, J. Henry	August 27, 1876.
Elliott, Mary E	April 10, 1880.
Ellis, Miss Mary C	August 28, 1881.
Estabrook, Miss Mary A. H	July 24, 1875.
Evans, Miss Ellen A	December 20, 1875.
Evans, Miss Ellen G	February 5, 1876.
Fairchild, Miss Hattie M	February 25, 1877.
Fallon, Joseph K	June 19, 1877.
Feller, Lorenzo	January 4, 1881.
Fenton, H. W	September 16, 1877.
Fink, Miss A. P	January 27, 1877.
Fisk, Juliet A	March 22, 1879.
Flint, Elmira T	November 1, 1879.

Educational *Diplomas*—Continued.

Name.	Expires.
Flint, Almira T	October 3, 1880.
Folger, Miss H. C	November 27, 1878.
Fonda, Charles E	July 9, 1877.
Foster, Mrs. E	February 11, 1877.
Foster, Mrs. Julia	May 26, 1876.
Fowler, B. F	May 17, 1881.
Fox, John	July 29, 1877.
Freman, G. N	August 29, 1880.
Frissell, Miss Sarah E	April 6, 1878.
Furlong, George	November 11, 1877.
Furlong, Robert	March 13, 1881.
Gabriel, Mrs. C. E	January 17, 1880.
Garlick, J. P	April 10, 1880.
Garrison, Gazena A	July 18, 1880.
Geer, Emily F	June 7, 1881.
Geis, S. W	July 10, 1878.
Germain, Miss Clara	May 13, 1879.
Goepp, G	January 3, 1879.
Godfrey, G. K	November 19, 1876.
Gordon, Wellington	November 13, 1875.
Gould, Miss M. J	January 27, 1877.
Granger, F. C	September 16, 1877.
Grant, Miss Ellen G	January 8, 1876.
Grant, Miss Helen A	December 13, 1879.
Gray, Miss Annie L	May 31, 1881.
Grear, Miss Jane E	February 11, 1877.
Greer, Miss C. E	December 13, 1879.
Gunn, Miss E. L	May 13, 1877.
Gunn, Sarah W	April 16, 1876.
Guthrie, N. L	May 7, 1876.
Haislip, Benjamin F	June 7, 1881.
Hall, Miss Annie J	February 19, 1876.
Hall, Miss F. M	February 8, 1881.
Hall, Maggie J	June 27, 1880.
Ham, Charles H	April 20, 1878.
Hamilton, Miss Addie	October 29, 1876.
Hamilton, Hiram M	November 7, 1880.
Hamilton, Rev. Hiram	June 7, 1881.
Hamilton, Mrs. W. H. H	December 13, 1879.
Harkness, Miss Margaret	December 3, 1876.
Hatch, J. L	February 19, 1880.
Hawks, Miss Carrie M	December 5, 1880.
Hawkins, J. O	June 27, 1880.
Hayes, John	July 9, 1877.
Hazen, P. J	November 7, 1880.
Henning, Irving P	February 19, 1876.

Educational Diplomas—Continued.

Name.	Expires.
Hewett, Roscoe	October 5, 1878.
Hiatt, Pleasant	March 24, 1880.
Higby, H. C	January 3, 1879.
Hoffman, Mrs. Mary L	July 22, 1877.
Howard, Emma	July 10, 1878.
Howe, Converse	March 5, 1876.
Howe, E. P	January 20, 1879.
Howell, S. S	July 10, 1878.
Hubbell, S. C	January 16, 1878.
Hughes, A. B	March 24, 1880.
Humphreys, Miss L. A	November 27, 1878.
Humphreys, Miss M. A	November 27, 1878.
Hunt, B. E	June 27, 1880.
Huntsinger, Mrs. Jennie	July 22, 1879.
Hurley, Miss J. M	July 16, 1876.
Hutton, Charles E	October 15, 1876.
Ingraham, B. F	July 22, 1879.
Itsell, A. J	December 19, 1876.
Jacks, Miss Fannie	March 22, 1879.
Jamison, J. H. S	September 22, 1881.
Janes, Miss Emma	December 31, 1875.
Jaycoax, Mrs. A. S	July 22, 1879.
Jenks, David W	April 10, 1880.
Jewett, Miss Fidelia	December 13, 1879.
Jewett, Miss Annie S	July 9, 1877.
Jewett, Miss Fidelia	May 27, 1877.
Johnson, G. N	December 18, 1880.
Johnson, G. W	March 24, 1880.
Johnson, Joseph W	August 29, 1880.
Jones, Addison	September 16, 1877.
Jones, J. T	March 11, 1877.
Jordon, John F	November 18, 1877.
Keegan, Miss Mary A	April 10, 1881.
Kellogg, M. D	October 22, 1876.
Kelso, John R	November 1, 1879.
Kelton, Mrs. Mary A	June 27, 1880.
Kendall, Sylvia A	October 3, 1880.
Kennedy, J. F	October 17, 1880.
Kerr, Theodore T	October 22, 1876.
Kimball, C. A	April 10, 1880.
Kincaid, Mrs. Mary W	September 10, 1876.
King, Charles E	March 22, 1879.
King, R. M	May 13, 1877.
Kingman, Mrs. M. V	September 22, 1881.
Kinkade, Letitia	August 7, 1881.

Educational Diplomas—Continued.

Name.	Expires.
Klink, John F	August 7, 1881.
Knighton, William A	January 4, 1881.
Knowlton, E. L	April 10, 1881.
Kottinger, H. M	February 10, 1878.
Kratzer, Miss Lella	May 17, 1881.
Lafferty, I. N	June 27, 1880.
Lamb, Miss Irene	April 20, 1878.
Lander, F. L	November 1, 1879.
Laurie, Miss B. M	January 20, 1879.
Law, John K	July 22, 1879.
Levy, Daniel	July 10, 1878.
Libby, Mrs Joseph S	July 23, 1876.
Lighte, Miss Pauline S	August 28, 1881.
Lillie, John B	December 5, 1880.
Lillie, Miss Sarah P	September 16, 1877.
Lippowitz, Max	August 29, 1880.
Lloyd, Mary A	September 22, 1881.
Loag, Emily T	April 2, 1876.
London, J	November 27, 1878.
Loudon, J	September 22, 1881.
Lovett, Charles E	July 10, 1878.
Lynch, Miss Tillie S	December 13, 1879.
Lynch, W. F. B	January 4, 1881.
Lyser, Albert	February 19, 1880.
Magoon, Wm. H	March 22, 1879.
Manning, Miss Agnes M	April 29, 1877.
Martin, A	February 25, 1877.
Martin, James M	January 4, 1881.
Marvin, Miss A	June 27, 1880.
Mathews, Mrs. M. E	August 29, 1880.
McArthur, Miss Annie	September 16, 1877.
McCarty, Thomas	July 9, 1877.
McColgan, Kate F	October 5, 1878.
McCormack, Harriet T	August 20, 1876.
McDonald, Mrs. N. R	December 20, 1875.
McDonald, W. P	January 22, 1880.
McDonall, Mrs. J	March 24, 1880.
McFadden, John	December 18, 1880.
McGlashen, C. F	July 10, 1878.
McGowan, Patrick H	March 24, 1880.
McKean, Lottie	August 29, 1880.
McKusick, H. P	September 22, 1881.
McManus, A. C	July 16, 1876.
McPhee, Miss V. J	March 22, 1879.
McReynolds, Joe	November 18, 1877.
Mea, John F	June 7, 1876.

Educational Diplomas—Continued.

Name.	Expires.
Meagher, John F	April 10, 1880.
Merritt, Julia E	March 24, 1880.
Metzger, C. L	September 16, 1877.
Middleton, A. W	October 4, 1877.
Middleton, Mrs. Eliza F	October 4, 1877.
Miles, Mrs. R. S	June 7, 1881.
Miller, John	April 8, 1877.
Miller, Lafayette	April 8, 1877.
Miller, Miss N. J	November 25, 1877.
Miller, John H	October 3, 1880.
Milliken, Mrs. E. A	July 22, 1877.
Minta, Wesley	November 7, 1880.
Mitchell, Miss Fannie	October 22, 1876.
Mondram, F. V. C	July 9, 1877.
Montgomery, Miss A. S	May 17, 1881.
Moore, Mrs. B. F	July 10, 1878.
Morgan, Richard	August 7, 1881.
Morris, Henry Z	November 11, 1877.
Murphy, Miss Mary	February 25, 1877.
Norman, L. F	August 7, 1881.
O'Connor, Miss Maria	March 8, 1879.
O'Laughlen, Mrs. Nellie	November 7, 1880.
Oliver, A. W	July 22, 1879.
Oliver, Mrs. C. F	July 22, 1879.
Ormstrong, Flora S	March 24, 1880.
Otis, C. W	April 28, 1876.
Overend, Miss E	February 11, 1877.
Owens, Miss Nellie M	June 13, 1877.
Owen, Miss Georgie	January 4, 1881.
Page, Miss Lizzie	November 18, 1877.
Palmer, Miss R. M	June 27, 1880.
Parker, James L	June 27, 1880.
Parker, Flora A	September 22, 1881.
Peachy, Thomas G	July 18, 1880.
Peadry, Frank A	October 3, 1880.
Pearce, Miss Carrie	August 7, 1881.
Peck, A. W	July 10, 1875.
Pedler, F. A	March 13, 1881.
Pendegast, H. B	January 4, 1881.
Penwell, Mrs. L. M	November 18, 1877.
Powell, David	August 5, 1876.
Powell, Miss Elizabeth	July 10, 1878.
Prag, Mrs. Mary	October 5, 1878.
Pratt, Miss Mary E	October 17, 1880.
Putnam, J. E	July 10, 1878.

Educational Diplomas—Continued.

Name.	Expires.
Rattan, V	May 22, 1880.
Ray, J. H	March 5, 1876.
Reavis, Walter Scott	October 3, 1880.
Redway, Jacques W	January 4, 1881.
Renfro, Lewis C	August 29, 1880.
Rice, L	July 9, 1877.
Robertson, William A	January 8, 1876.
Robertson, George B	June 27, 1880.
Rogers, Arthur	April 8, 1877.
Rogers, James	April 6, 1878.
Roper, J. W	July 29, 1877.
Royall, J. P	March 13, 1881.
Ryan, Miss Amanda	August 4, 1879.
Ryder, Miss L. E	August 29, 1880.
Salisbury, Mary A	November 7, 1880.
Sankey, Mrs. Mary J	July 18, 1880.
Saunders, Samuel	March 13, 1881.
Saxon, T. A	March 13, 1881.
Sears, Miss Marion	February 25, 1877.
Seawell, J. H	January 20, 1879.
Shaw, Miss Annie J	August 28, 1881.
Shearer, Mrs. C. C	January 13, 1877.
Sherman, E. B	July 9, 1877.
Sherman, Ella Imogene	June 28, 1881.
Sherman, Miss M. F	February 19, 1880.
Short, Miss Julia B	May 27, 1877.
Sill, E. R	January 20, 1879.
Sinex, J. H	January 20, 1879.
Smith, James D	November 6, 1877.
Smith, Ansel	August 29, 1880.
Smith, Miss Grace	October 17, 1880.
Smith, James D	November 7, 1880.
Sollinger, J. A	November 7, 1880.
Soule, Marie L	December 5, 1880.
Southeimer, Jno. J	August 7, 1881.
Squires, W. E	October 2, 1877.
Standish, Miss H. M	December 18, 1880.
Standeford, Mrs. N. D	March 13, 1881.
Stegman, Miss Mattie A	August 6, 1876.
Stincen, Emma E. C	March 22, 1881.
Stoddard, C. W	October 2, 1877.
Stone, W. W	July 10, 1878.
Stowell, F. A	February 11, 1879.
Sumner, John H	February 3, 1878.

Educational Diplomas—Continued.

Name.	Expires.
Taylor, Mrs. H. P	May 17, 1881.
Temple, Miss Emma	May 13, 1879.
Thomas, J. R	February 25, 1877.
Thompson, Miss Louisa	March 13, 1881.
Thompson, J. N	July 22, 1879.
Thurton, M. S. L	August 30, 1879.
Tillotson, Henry Ira	January 10, 1880.
Todd, H. J	July 9, 1877.
Towle, C. B	August 6, 1876.
Towle, Mrs. Lizzie B	January 13, 1877.
Trout, Daniel H	January 10, 1880.
True, Charles F	October 5, 1878.
Turner, H. F	August 28, 1881.
Underwood, J. G	January 7, 1877.
Van Dorn, V. J	August 29, 1880.
Van Schaick, Mrs. Mary A	May 13, 1879.
Vestal, F. A	July 10, 1878.
Wade, Miss M	August 5, 1877.
Walker, Miss Alice	September 23, 1877.
Walker, Charles H	June 27, 1880.
Wallace, W. B	July 22, 1879.
Walsh, Miss Nellie E	August 30, 1879.
Wanzer, Mrs. L. M. F	April 6, 1878.
Ward, Miss Mary A	December 5, 1880.
Watkins, Emory	January 20, 1879.
Watson, B. J	November 6, 1875.
Watson, Miss Lizzie J	July 22, 1879.
Webb, Sallie B	June 27, 1880.
Wells, Jos. H	February 8, 1881.
Wenk, Robert E	February 8, 1881.
Westbay, Miss L. M	July 16, 1876.
Weston, Miss Ada	January 16, 1878.
Wheelock, Mrs. D. R	December 13, 1877.
White, Emmons	February 19, 1876.
White, Miss Louise E	December 13, 1879.
White, Mrs. Sara	April 10, 1881.
White, A. F	August 28, 1881.
Whitmore, Ella L	May 13, 1879.
Wideman, James	September 22, 1881.
Wilson, James K	March 19, 1876.
Wilson, H. C	March 13, 1881.
Wood, Jessie	October 22, 1876.
Wood, Mrs. N. A	July 10, 1881.
Woodward, Mrs. N. Zoraida	August 7, 1881.
Woodworth, Mrs. J. E	December 13, 1879.

Educational Diplomas—Continued.

Name.	Expires.
Wooll, Miss Hattie	August 7, 1881.
Wright, Mrs. E	April 8, 1877.
Yates, W. A	April 10, 1880.
Yates, Miss Lizzie	January 4, 1881.
Young, Nestor A	August 7, 1881.
Yule, John	August 5, 1876.
Zimmerman, William	December 19, 1876.

First Grade Certificates.

Name.	Expires.
Aaron, Miss Amelia	March 24, 1878.
Ackerman, Miss Dell	September 22, 1879.
Adams, Clara A	May 22, 1878.
Alderson, Miss M. J	March 22, 1877.
Allen, Louisa D	July 10, 1879.
Allison, Arminta E	March 10, 1874.
Ambrose, Warren B	May 31, 1879.
Anderson, D. M	October 18, 1877.
Anderson, Miss May	October 18, 1877.
Anderson, George P	June 27, 1878.
Arthurton, S. L	March 24, 1878.
Ashley, Miss Florence	December 13, 1875.
Ashley, Ella E	July 18, 1878.
Ashton, John	April 2, 1877.
Ashton, Mrs. N. S	January 10, 1878.
Ashurst, Miss Pamela E	December 5, 1878.
Aubrey, Mrs. Emily	April 6, 1876.
Augustine, Samuel M	January 16, 1879.
Auld, Cecilia M	March 24, 1878.
Avery, Miss Sarah	March 8, 1877.
Avery, Sophie L	August 29, 1878.
Ayer, Henry	September 22, 1879.
Babcock, Milton S	October 18, 1877.
Babcock, Isabel	September 22, 1879.
Baker, F. E	January 16, 1876.
Baldwin, F. T	April 6, 1876.

First Grade Certificates—Continued.

Name.	Expires.
Banks, Henry H	July 10, 1879.
Banks, Lily	September 22, 1879.
Bannan, Miss Maggie	August 30, 1877.
Barbour, William R	July 18, 1878.
Barnes, Miss Eliza B	April 10, 1879.
Barnes, Emmogene A	March 26, 1879.
Barnes, Margaret S	August 7, 1879.
Barrett, Dora J	August 30, 1877.
Barrett, Miss Franc C	August 7, 1879.
Barry, Charlotte M	January 10, 1878.
Bateman, J. N	November 1, 1877.
Batten, Mary	October 31, 1878.
Bateman, Henry	March 26, 1879.
Beal, Charles R	May 31, 1879.
Beardslee, Seely T	June 25, 1879.
Beasley, E. C	October 18, 1877.
Beggs, J. J	September 22, 1879.
Bellinger, Mary	February 19, 1878.
Benjamin, Miss J. I	July 22, 1877.
Benfey, Myra Pauline	September 22, 1879.
Bennett, Glora F	August 7, 1879.
Bennett, Minnie A	March 28, 1878.
Bentley, Lettie E	January 10, 1878.
Bertolet, Albert	August 7, 1879.
Bicknell, Bertha A	January 10, 1878.
Bightmire, S. A	May 22, 1878.
Bird, Mary	March 28, 1878.
Birdsall, Miss Rebecca B	July 10, 1879.
Black, Mattie C	June 27, 1878.
Blackmar, Frank W	August 28, 1879.
Blackstaff, M. E D	March 28, 1878.
Blaisdell, Sabine Wales	July 18, 1878.
Blake, Charles M	July 10, 1876.
Blakely, James O	October 18, 1877.
Bloomer, A. C	December 13, 1877.
Bodwell, Miss L. B	April 10, 1879.
Bonnard, Miss E. A	February 19, 1878.
Bowse, Ellen F	July 10, 1879.
Boyden, Edgar A	April 10, 1878.
Boyers, Carrie Lee	July 10, 1879.
Boyle, Mary	July 10, 1879.
Boyle, Miss S. J	February 19, 1878.
Boynton, S. S	April 10, 1878.
Bradner, W. F	August 29, 1878.
Bradnu, Mittie F	May 17, 1879.
Bradshaw, W. R	August 29, 1878.
Brady, Theresa E. B	September 22, 1879.
Bragg, Miss R. H	October 31, 1878.

First Grade Certificates—Continued.

Name.	Expires.
Bragg, Miss Lizzie	October 31, 1878.
Broadbent, Elijah	June 25, 1879.
Brooks, Miss Addie	August 30, 1877.
Brooks, E. R	March 28, 1878.
Brooks, Elisha	April 10, 1879.
Brooks, Elisha	July 10, 1879.
Brown, James B	January 20, 1877.
Brown, George J	October 18, 1877.
Brown, Charles W	July 18, 1878.
Browne, James	May 13, 1877.
Bruch, Louis	March 8, 1877.
Brumley, Miss M. J	March 24, 1878.
Buckley, Emma S	March 26, 1879.
Buckman, A. E	August 4, 1877.
Buel, Emma W	April 10, 1878.
Bunker, Carrie R	September 22, 1879.
Burke, Mrs. L. K	November 22, 1875.
Burke, Jennie	March 24, 1878.
Burscough, Lizzie	July 10, 1879.
Burt, Minnie Clara	March 26, 1879.
Bush, Mrs. Ellen H	May 13, 1877.
Bush, Solomon	July 22, 1877.
Butler, Miss Kate	January 3, 1877.
Butler, Miss Orpha	January 16, 1879.
Butterfield, Ella E	August 7, 1879.
Butterfield, S. H	October 31, 1878.
Byrne, Hugh J	October 6, 1876.
Byrne, Hugh J	August 28, 1879.
Caginn, Jesse M	March 22, 1877.
Cahill, Josephine	March 8, 1877.
Caldwell, Mrs. M. E	May 22, 1878.
Call, Mattie C	October 31, 1878.
Callahan, Mary E	September 22, 1879.
Campbell, Miss M. M	April 2, 1877.
Campbell, Ruth G	June 27, 1878.
Carithers, Eli	October 31, 1878.
Carlisle, Cannie	July 18, 1878.
Carr, Francis	October 3, 1878.
Carr, Mary E	March 26, 1879.
Carrau, Celina R	February 8, 1879.
Carroll, Anna	March 8, 1877.
Carswell, Ella W	March 28, 1878.
Carter, Miss Louisa	October 25, 1875.
Carusi, Samuel P	September 22, 1879.
Casey, Mary Elizabeth	January 16, 1879.
Casterlin, Mrs. M. A	January 16, 1879.
Casterlin, J. Bartine	November 7, 1878.

First Grade Certificates—Continued.

Name.	Expires.
Chamberlain, Cynthia R	June 27, 1878.
Chase, Miss Hattie A	September 22, 1879.
Chase, Mrs. Alice J	September 22, 1879.
Childs, Helen	June 27, 1878.
Chipman, Samuel J	March 8, 1877.
Church, W. S	July 18, 1878.
Ciprico, Miss Anita	February 2, 1878.
Ciprico, Evelyn	July 10, 1879.
Clark, Miss E. M	January 16, 1876.
Clark, Ella D	January 10, 1878.
Clark, Mattie A	April 10, 1878.
Clark, Mary E	July 18, 1878.
Clarke, Charlotte K	March 26, 1879.
Classen, Louise M	January 16, 1879.
Claussy, Miss Annie Maud	September 22, 1879.
Clery, Mrs. Mary L	July 10, 1879.
Cogswell, Franklin	April 6, 1876.
Colby, Julia E	January 10, 1878.
Colby, Mrs. Mary A	May 17, 1879.
Cole, Marie	March 26, 1879.
Cole, Miss Emma F	September 22, 1879.
Coleman, Jr., Charles	August 29, 1878.
Congdon, James S	January 16, 1876.
Conmy, E. A	March 22, 1877.
Connell, Sadie	September 22, 1879.
Conroy, Lizzie	February 19, 1878.
Convis, Mrs. M. E	October 17, 1878.
Coolidge, Miss A	January 22, 1878.
Coolidge, Abbie	October 31, 1878.
Cooper, Mrs. F. A	April 10, 1878.
Cory, Lizzie	March 28, 1878.
Cory, Nellie	April 10, 1879.
Cosgriff, Mrs. Amelia	October 17, 1878.
Cottle, Annetta	April 2, 1877.
Courter, H. F	November 1, 1877.
Cowie, Annie B	March 26, 1879.
Cox, Beverly B	September 22, 1879.
Cox, Miss K. M	January 10, 1878.
Cox, Mary M	January 4, 1879.
Coyner, J. M	February 2, 1878.
Craddock, Sarah E	August 28, 1879.
Craid, Miss Elizabeth	August 28, 1879.
Crane, George	April 2, 1877.
Crane, Amanda	October 18, 1877.
Creighton, Mrs. A. M	February 11, 1877.
Crofton, Miss K	January 10, 1878.
Crothers, Caroline H	December 13, 1877.

First Grade Certificates—Continued.

Name.	Expires.
Crumry, Alice A	March 28, 1878.
Custer, Mrs. Anna M	December 5, 1878.
Dakin, William J	August 4, 1877.
Dame, Miss Mary L	June 7, 1879.
D'Ancona, Alexander D	July 10, 1879.
Dascomb, Charles	July 22, 1877.
Davis, Levi	August 29, 1878.
Davies, Abbie A	March 26, 1879.
Day, Frances M	March 28, 1878.
Day, F. H	March 13, 1879.
Deacon, S. Anna	October 3, 1878.
De Nure, D. D	October 18, 1877.
Dickey, Herbert S	July 10, 1879.
Dilley, A	September 22, 1879.
Dippel, Frances H	October 31, 1878.
Dixon, Bessie	March 26, 1879.
Donnelly, Laura J	September 22, 1879.
Doyle, Irene M	June 25, 1879.
Drake, Charles M	July 18, 1878.
Drake, Milton	October 31, 1878.
Drake, Elmer	January 10, 1878.
Duenkel, William	April 2, 1877.
Dunphy, Jennie Collins	October 31, 1878.
Dunphy, May R	October 31, 1878.
Duraind, Mary A	September 22, 1879.
Dwinell, Alice H	December 13, 1877.
Dwinell, Jennie K	December 13, 1877.
Eastman, Augusta	May 22, 1878.
Edwards, W. H	September 9, 1875.
Elder, J. C	October 3, 1878.
Elliott, Mrs. E. J	February 19, 1878.
Elliott, Kate	August 7, 1879.
Ellis, Carrie M	September 22, 1879.
Ellis, Kate Hunter	July 10, 1879.
Ellis, Miss M. C	April 2, 1877.
Ellis, Miss Nannie	April 2, 1877.
Ennis, Charles	July 18, 1878.
Ensign, Sarah Jane	March 13, 1879.
Ephraim, Adeline	July 10, 1879.
Ephraim, Jenette	July 10, 1879.
Evans, Miss D. M	July 22, 1875.
Evans, Miss L. M	
Everts, Edward	January 16, 1879.
Fablinger, Lewis	May 28, 1877.
Fagg, Belle	March 26, 1879.

First Grade Certificates—Continued.

Name.	Expires.
Fahey, Maggie	August 4, 1877.
Faith, Chauncey	September 22, 1879.
Farmer, Fannie	March 26, 1879.
Farnham, Charles E	March 26, 1879.
Farnsworth, Julia B	March 26, 1879.
Featherly, Henrietta	May 22, 1878.
Fennell, Lizzie	July 10, 1879.
Field, Miss Sarah	February 8, 1879.
Finney, Miss F. A	June 27, 1878.
Fiske, H. W	August 4, 1877.
Fitzgerald, Nehemiah	January 16, 1879.
Fitzpatrick, Ella M	January 16, 1879.
Fleming, Katy	July 18, 1878.
Floyd, Enos F	November 1, 1877.
Footman, Henry E	March 22, 1877.
Ford, J. A	April 10, 1878.
Ford, Plin	August 7, 1879.
Foss, Benjamin R	July 10, 1879.
Fowler, Foland Payson	October 17, 1878.
Fowler, D. F	July 22, 1877.
Fowler, B. F	April 6, 1876.
Freeman, G. N	January 20, 1877.
Fross, William F	March 8, 1877.
Furlong, Robert	January 10, 1878.
Gabriels, Mrs. C. E	April 6, 1876.
Gage, Lewis Cass	July 10, 1879.
Gaines, Chauncey	January 16, 1879.
Garland, Miss A. A	April 10, 1878.
Garton, Marietta	August 28, 1879.
Gates, M. H	September 22, 1879.
Gates, Mrs. Sophia B	July 10, 1879.
Gavigan, Annie E	September 22, 1879.
Gavin, Paul Achille	January 16, 1879.
Geer, Emily F	March 24, 1878.
Germain, Sallie	July 18, 1878.
Gillis, Hudson B	July 18, 1878.
Gilman, Martha A	October 31, 1878.
Gilmor, Harriet N	March 26, 1879.
Gilson, J. C	October 31, 1878.
Glidden, R. Y	October 31, 1878.
Goepp, G	January 22, 1878.
Goldsmith, Bertha	September 22, 1879.
Goodcell, Henry	March 8, 1877.
Goode, Richard	July 18, 1878.
Gordon, Miss Mary A	November 7, 1878.
Goucher, G. G	April 2, 1877.
Gourley, Jennie A	March 24, 1878.

First Grade Certificates—Continued.

Name.	Expires.
Goustiaux, Albertine	January 22, 1878.
Graham, Miss E. E. V	November 1, 1877.
Grasty, Thomas P	March 8, 1877.
Gray, Miss A. L	March 24, 1878.
Gray, Charles P	September 22, 1879.
Gray, S. P	August 28, 1879.
Green, Kate	May 22, 1878.
Greenwood, Lula Evangie	August 28, 1879.
Greer, Miss M. L	August 30, 1877.
Griffin, Lizzie M	September 22, 1879.
Griffin, Martha E	September 22, 1879.
Grigsby, Phebe P	November 7, 1878.
Grigsby, Florence	March 28, 1878.
Guild, Pacific	March 28, 1878.
Gummer, Lillie A	November 25, 1875.
Haislip, Benjamin F	November 6, 1875.
Haley, William T	July 22, 1877.
Hall, Miss F. M	January 10, 1878.
Hall, Mary C	July 18, 1878.
Hall, Alice J	September 22, 1879.
Hammel, Mrs. A. H	July 22, 1877.
Hammett, Laura E	January 10, 1878.
Hamilton, William Joseph	September 22, 1879.
Hamilton, James T	January 16, 1879.
Hammond, William H	September 22, 1879.
Hammond, S. Estelle	March 28, 1878.
Hammond, Hulda A	March 28, 1878.
Hanck, Julia L	March 26, 1879.
Hanks, Miss C. M	November 27, 1876.
Hanlon, Amelia I	September 22, 1879.
Hannah, H. O	April 28, 1879.
Hansbrough, James K	September 22, 1879.
Hanscom, Nathan C	March 26, 1879.
Hansford, Thaddeus	January 16, 1879.
Hanson, A. J	August 4, 1877.
Hardy, George H	November 1, 1877.
Harkness, George S., Jr	April 10, 1879.
Harrington, Maggie J	August 4, 1877.
Harris, Dora B	March 8, 1877.
Harris, Miss S. J	January 10, 1878.
Harris, Miss Lizzie	September 22, 1879.
Hartson, Iola S	April 10, 1879.
Harvey, Oliver T	January 16, 1879.
Haskins, Miss Harriet	March 13, 1879.
Hatch, J. L	July 22, 1877.

First Grade Certificates—Continued.

Name.	Expires.
Havens, H. Roscoe	September 22, 1879.
Havens, Carrie	January 4, 1879.
Hawks, Miss Emma A	January 20, 1877.
Hawkins, J. V	May 13, 1877.
Hayburn, Annie M	December 5, 1878.
Hayden, Mrs. Mary E	November 7, 1878.
Hazen, P. J	January 20, 1877.
Heard, Miss Jennie	October 31, 1878.
Heath, Alice	March 26, 1879.
Heath, Henry Hiram	September 22, 1879.
Heckman, H. H	October 18, 1877.
Helm, William T. R	September 22, 1879.
Hemler, Lizzie	August 7, 1879.
Hemsted, Lucy	November 1, 1877.
Henderson, Miss M. J	August 29, 1878.
Hendrix, Mary	March 8, 1877.
Hendry, Maggie	March 22, 1877.
Heney, Julia A	July 18, 1878.
Henn, Carrie M	March 28, 1878.
Henning, David F	April 10, 1878.
Henning, David F	March 26, 1879.
Hess, Tillie F	October 31, 1878.
Hiatt, Pleasant	March 8, 1877.
Hiatt, Mrs. Henrietta H	January 16, 1879.
Hickman, J. B	July 18, 1878.
Hill, Eugenio K	June 27, 1878.
Hill, Mrs. Nettie G	July 18, 1878.
Hill, Miss Nettie E. Garton	November 7, 1878.
Hilton, Stephen	September 22, 1879.
Hines, Gideon D	September 22, 1879.
Hinkle, Jacob R	August 7, 1879.
Hinton, J. W	July 22, 1877.
Hitchcock, Helen Munro	September 22, 1879.
Hixon, George C	July 18, 1878.
Hochholzer, Harriet	February 2, 1878.
Hockheimer, Ettie	September 22, 1879.
Hogan, Mary J	June 27, 1878.
Hogbin, R. M	November 1, 1877.
Holbrook, Edw	March 22, 1877.
Holbrook, Anna	September 22, 1879.
Holdsworth, Martha A	August 4, 1877.
Hollenbeck, Minnie B	March 26, 1879.
Hollingsworth, Maria	April 10, 1879.
Holmer, M. D	October 6, 1876.
Holton, George M	October 18, 1877.
Hopkins, Anna	September 22, 1879.
Hopkins, Kate E	September 22, 1879.
Horton, George Wallace	October 3, 1878.

First Grade Certificates—Continued.

Name.	Expires.
How, Alvin Jared	March 22, 1879.
Howard, Millie S	March 26, 1879.
Howell, Mark	April 6, 1876.
Howell, Henry H	November 6, 1875.
Hunt, S. M	January 20, 1877.
Hunter, Jno	October 31, 1878.
Husteel, Frederic Monroe	September 22, 1879.
Hutchins, Kate	April 10, 1878.
Inskip, Ph. Seward	July 18, 1878.
Intermille, Rosina	March 26, 1879.
Irelan, Jennie B	January 16, 1879.
Jackson, Ella A	March 28, 1878.
Jacobs, Miss R	February 19, 1878.
Jacobs, Miss Jennie S	October 5, 1876.
Jacobs, Celia	September 22, 1879.
Jamison, J. H. S	May 13, 1877.
Janvier, Allen E	April 10, 1879.
Jenks, David W	April 2, 1877.
Jewell, W. Jerome	March 28, 1878.
Jewett, Annie S	February 8, 1879.
Jewell, Ruby Annie	July 10, 1879.
Johnson, Isabelle	March 28, 1878.
Johnson, Samuel E	July 18, 1878.
Johnston, Miss Clara	July 22, 1877.
Johonnot, Miss Marion H	September 22, 1879.
Jones, E. Benton	April 2, 1877.
Jones, W. H	July 10, 1876.
Jones, Carey W	March 8, 1877.
Jones, Sarah M	May 13, 1877.
Jones, Nellie R	March 26, 1879.
Kane, Richard	January 10, 1878.
Kaplan, Marie E	July 18, 1878.
Keefer, Sallie E	March 28, 1878.
Keegan, Mary A	March 24, 1878.
Kelley, Susie E	January 16, 1879.
Kellogg, Franklin E	January 10, 1878.
Kellogg, A. E	February 19, 1878.
Kelsey, Miss N. M	November 27, 1876.
Kelso, John	July 10, 1876.
Kelso, Luella	March 8, 1877.
Kendall, Marion A	July 10, 1879.
Kenniston, Charles M	August 29, 1878.
Kenniston, Mrs. C. M	November 7, 1878.
Kent, Isabelle B	March 24, 1878.
Kerr, Miss Margaret	July 10, 1879.

First Grade Certificates—Continued.

Name.	Expires.
Kessler, Christian	February 19, 1878.
Ketchum, Ariadne G	March 28, 1878.
Keys, Mary E	February 19, 1878.
Killpatrick, E. C	December 5, 1878.
Kimball, C. H	April 2, 1877.
Kimball, Miss Mary S	March 8, 1877.
Kinkade, Letitia	July 18, 1878.
King, Miss Florella	October 17, 1878.
Kingman, Mrs. M. V	August 29, 1878.
King, Mamie E	January 4, 1879.
Kingsbury, Lettie	September 22, 1879.
Kinsey, Charles Caswell	September 22, 1879.
Kirkland, Cordelia S	January 16, 1879.
Klenck, J. F	October 31, 1878.
Kneedler, Susie E	March 28, 1878.
Knight, Ed. D	July 22, 1877.
Knowlton, Miss L. M	February 19, 1878.
Kratzer, Lella	March 8, 1877.
Kraus, Emma F	April 10, 1879.
Kraus, Sophia M. F	April 18, 1879.
La Grange, Anna E	May 22, 1878.
Lambert, Daniel	March 22, 1877.
Lampkin, Henry L	November 25, 1875.
Lanfranchi, C	January 22, 1878.
Langan, George	May 22, 1878.
Langworthy, Miss Mary Agnes	September 22, 1879.
Leach, Mira	July 18, 1878.
Leahy, Mary A	March 26, 1879.
Leary, Joseph	July 10, 1879.
Ledyard, J. L	January 3, 1877.
Leete, Christine Rosabel	July 10, 1879.
Leimbach, Albert E	July 10, 1879.
Leonard, Carrie	March 24, 1878.
Leppien, Miss Dora	January 3, 1877.
Levy, Daniel	February 2, 1878.
Lewis, Fannie	January 10, 1878.
Lewis, J. A	August 7, 1879.
Lewis, Mary	March 26, 1879.
Lighte, Miss Pauline	March 24, 1878.
Lillie, John B	August 29, 1878.
Lipman, Miss M	February 19, 1878.
Lipowitz, M	August 4, 1877.
Little, Miss Mary	August 7, 1879.
Little, David F	March 26, 1879.
Littlefield, Miss N. A	May 17, 1879.
Lloyd, Julius S	September 22, 1879.
London, Jacques	February 2, 1878.

First Grade Certificates—Continued.

Name.	Expires.
Loofbourrow, Elias	January 16, 1879.
Love, Mrs. Josie S	September 22, 1879.
Lowe, Sarah E	March 22, 1877.
Lowell, Emma	October 31, 1878.
Lundt, Jennie C	January 16, 1879.
Lynch, W. F. B	March 8, 1877.
Lynch, Mary E	July 22, 1877.
Lynch, Ada M	April 10, 1878.
Maddux, Mary	January 10, 1878.
Mahoney, Miss Mary A	July 10, 1879.
Mann, S. J	October 3, 1878.
Markham, Charles E	October 3, 1878.
Marks, Charles H	November 11, 1875.
Martin, J. M	April 2, 1877.
Martin, Julia	March 8, 1877.
Martin, A. F	October 18, 1877.
Martin, Edith J	March 28, 1878.
Marvin, Miss Adella	March 22, 1877.
Martin, Amelius F	May 17, 1879.
Martin, Kate Nelson	March 26, 1879.
Mast, Miss Regina	September 22, 1879.
Mathews, Ruth M	July 10, 1879.
Mathews, Mary	May 22, 1878.
Matthews, Lucy M	September 22, 1879.
Mattick, J. N	November 27, 1876.
May, Isabel	March 26, 1879.
Maurer, Clara	January 10, 1878.
McCall, Charles M	November 1, 1877.
McCarthy, Mrs. S. L	October 3, 1878.
McCleery, Lizzie	October 31, 1878.
McConnell, James I	July 10, 1876.
McDivitt, S. P	October 3, 1878.
McDonald, W. P	April 6, 1876.
McDonald, J. J	January 10, 1878.
McDonald, Miss Kate	December 13, 1877.
McDonald, Mary	March 26, 1879.
McEwen, John	July 22, 1877.
McFarland, Wm. M	July 10, 1879.
McFadden, John	January 10, 1878.
McFadden, Agnes	November 7, 1878.
McGaughey, Miss Fannie G	June 25, 1879.
McHugh, Peter	October 18, 1877.
McHugh, Peter	June 27, 1878.
McKean, William G	October 3, 1878.
McKown, Mrs. M. E	May 17, 1879.
McLafferty, B. S	May 13, 1877.
McLean, Robert A	November 6, 1875.

First Grade Certificates—Continued.

Name.	Expires.
McLean, Miss Christine	November 18, 1875.
McKusick, H. P	December 13, 1877.
McKean, Miss A. M	February 19, 1878.
McPhaill, J. S	September 22, 1879.
Mead, Emmeline R	March 28, 1878.
Meek, Anna P	April 6, 1876.
Menges, Caroline A	June 7, 1879.
Merritt, Miss Julia E	January 20, 1877.
Merritt, Mary	March 8, 1877.
Merritt, Isabella	March 8, 1877.
Metcalf, Mary F	May 22, 1878.
Michaelson, Louis Chr	January 10, 1878.
Michener, Mrs. Mary E	October 31, 1878.
Mulgrew, Miss Mary J	October 31, 1878.
Miller, J. H	July 24, 1875.
Miller, Amanda	March 28, 1878.
Miller, Charles W	March 28, 1878.
Miller, Sarah E	August 29, 1878.
Miller, Frank B	August 28, 1879.
Mills, Myron	December 5, 1878.
Minta, Wesley	March 22, 1877.
Montgomery, Alberta S	March 22, 1877.
Moore, Mrs. M. E	February 8, 1879.
Moore, Ira	July 10, 1879.
Moore, J. P	December 13, 1877.
Morey, Sabie	March 22, 1877.
Morgan, Rose E	April 28, 1879.
Morton, Sarah E	July 18, 1878.
Mower, Edith	September 22, 1879.
Morey, Sabra E	March 26, 1879.
Morford, Nathan A	April 6, 1876.
Mullens, Miss H	January 22, 1878.
Mumford, Mrs. M. E	July 18, 1878.
Mumford, Mrs. M. E	March 28, 1878.
Murdock, Maria E	March 28, 1878.
Murdock, Ella	March 8, 1877.
Murnan, John T	January 16, 1876.
Murphy, Annie L	March 28, 1878.
Murphy, Isabelle	April 10, 1878.
Murray, Adam	November 1, 1877.
Muth, Hattie	September 22, 1879.
Nachtman, Miss Justina	February 19, 1878.
Nash, Miss B. S	July 18, 1878.
Neary, Annie J	March 26, 1879.
Newcomer, Jacob	November 1, 1877.
Nolen, M. J	August 4, 1877.
Northcutt, Cary A	May 13, 1877.

First Grade Certificates—Continued.

Name.	Expires.
Norvell, James A	January 10, 1878.
Noyes, Annie L	September 22, 1879.
O'Brien, Miss Kate	March 22, 1879.
O'Brien, Miss Juliet F	September 22, 1879.
Ogilvie, Charlotte A	February 8, 1879.
Oglesby, M. A	May 22, 1878.
O'Leary, Katy R	May 22, 1878.
O'Loughlin, Nellie	May 22, 1878.
Oliver, Joseph Campbell	July 18, 1878.
O'Niel, M. A	May 13, 1877.
O'Niel, Mary H	January 20, 1877.
Ormsbee, Miss Jane	January 17, 1878.
O'Rourke, Maggie	March 28, 1878.
Osmer, Mrs. E. C	December 13, 1877.
Owen, Miss Georgie	April 2, 1877.
Packard, Lizzie A	January 16, 1879.
Palmer, Anna M	May 22, 1878.
Palmer, Maggie H	July 18, 1878.
Parker, Flora A	July 18, 1878.
Pascoe, William, Jr	March 26, 1879.
Paulk, Charles A	August 4, 1877.
Peaslee, May E	September 22, 1879.
Peck, Helen E	September 22, 1879.
Pedler, Mrs. F. A	January 16, 1879.
Pedler, F. M	July 10, 1876.
Pelton, Malvina Chase	April 10, 1879.
Pendegast, H. B	January 27, 1876.
Perrigo, Mary J	May 22, 1878.
Perry, Grace H	September 22, 1879.
Persing, Georgia	February 2, 1878.
Pettis, Miss Lizzie	January 3, 1877.
Peter, N. Effie	June 27, 1878.
Pfeiffer, Laura	July 10, 1879.
Phelps, Augusta M	March 13, 1879.
Phillips, Mrs. A. M	June 27, 1878.
Pierce, Miss Cary	March 8, 1877.
Pierce, Miss Carrie	January 3, 1877.
Pinkham, Caroline H	November 1, 1877.
Pitcher, Charlotte M	October 31, 1878.
Poage, John A	August 28, 1879.
Poindexter, Robert W	March 8, 1877.
Poindexter, Robert W	July 22, 1877.
Poston, John M	November 1, 1877.
Potter, Lila L	September 22, 1879.
Powers, Talbot P	October 31, 1878.
Pratt, Miss E	May 28, 1877.

First Grade Certificates—Continued.

Name.	Expires.
Pratt, Alexis L	March 22, 1879.
Prentiss, George W	March 22, 1877.
Price, Harrison	October 18, 1877.
Preston, Benjamin T. K	October 18, 1877.
Proudfoot, William A	July 10, 1879.
Pugh, Miss F. M	November 25, 1875.
Ranlet, May	July 10, 1879.
Raven, H. S	March 22, 1877.
Rayl, Mrs. Martha	January 16, 1879.
Redding, Miss Dora C.	October 18, 1877.
Redway, Jacques W	August 4, 1877.
Reed, Dayton A	October 18, 1877.
Reilly, M. J	January 10, 1878.
Rhodes, E. J	August 29, 1878.
Richards, Miss Rena	April 6, 1876.
Righter, F. M	November 1, 1877.
Riley, Ella	July 10, 1879.
Riley, John F	July 10, 1879.
Ritter, C. M	November 27, 1876.
Rixon, Charity K	May 18, 1877.
Roberts, Lizzie	March 8, 1877.
Robinett, Margretta M	September 22, 1879.
Robinson, Miss Susie E	April 6, 1876.
Robinson, Joseph W	October 18, 1877.
Robinson, Mrs. M. S. P	December 13, 1877.
Robinson, Mary E	August 7, 1879.
Roche, Constantine V	July 18, 1878.
Roche, Annie	July 10, 1879.
Ronald, J. F	August 7, 1879.
Root, Miss Leilla A	January 10, 1878.
Root, Ellis J	March 26, 1879.
Rousseau, Mrs. Lida	October 31, 1878.
Rowe, Miss Lizzie	August 7, 1879.
Royce, Miss Ruth	November 7, 1878.
Royce, Ella J	June 27, 1878.
Ruddock, John C	May 22, 1878.
Said, Ella	March 22, 1877.
Salisbury, Mary A	July 22, 1877.
Sanborn, Allen P	March 22, 1877.
Sargent, Lizzie	March 26, 1879.
Sarles, Mrs. H. W	January 10, 1878.
Sarvis, G. C	October 3, 1878.
Saunders, Samuel	August 4, 1877.
Savage, Miss Nellie H	April 20, 1878.
Saxe, Heman A	October 31, 1878.
Saxon, T. A	August 4, 1877.

First Grade Certificates—Continued.

Name.	Expires.
Schenck, Emma	March 26, 1879.
Schultz, F. W. A	January 20, 1877.
Scott, W. S	April 2, 1877.
Seaman, Edward M	May 17, 1879.
Seavey, Oscar F	January 10, 1878.
Seeber, Zenaide	May 22, 1878.
Shaw, Theodore Stanfield	July 10, 1879.
Shearer, Flora M	April 10, 1879.
Sherman, Miss F. M	April 6, 1876.
Sherman, Ella Imogene	June 27, 1878.
Shinn, Milicent W	September 22, 1879.
Shirley, James W	March 26, 1879.
Sickal, M. T	May 13, 1877.
Silliman, C. H	May 31, 1879.
Simmonds, Miss E. P	January 3, 1877.
Sisson, Coraline M	August 7, 1879.
Skinner, Miss R. O	November 27, 1875.
Slack, Clay H	October 31, 1878.
Slater, Charlotte	April 10, 1878.
Slater, Miss Henrietta	April 2, 1877.
Slaven, Thomas Harrison	September 22, 1879.
Smalley, Mrs. H. H	July 10, 1879.
Smith, Ansel	April 2, 1877.
Smith, John W	June 27, 1878.
Smith, Lyman D	October 31, 1878.
Smith, Eleanor M	October 31, 1878.
Smith, Albert A	September 22, 1879.
Smith, J. A	August 7, 1879.
Smith, Stanley A	September 22, 1879.
Snell, Richard B	January 16, 1879.
Snow, Delia R	March 8, 1877.
Snow, Thatcher Newton	September 22, 1879.
Soulé, Maria L	November 1, 1878.
Sontheimer, J. J	October 31, 1878.
Soward, Frank D	July 18, 1878.
Spring, Mrs. Fannie	October 31, 1878.
Sprott, Maggie	February 19, 1878.
Sproul, Etha F	October 18, 1877.
Standeford, Mrs. N. D	January 10, 1878.
Standish, Miss H. M	April 2, 1877.
Starr, Nellie	March 8, 1877.
Stevens, Miss Eliza	July 10, 1876.
Stevens, Miss Annie	February 19, 1878.
Stevenson, Helen R	March 22, 1877.
Stewart, Miss Frances A	October 5, 1876.
Stiles, R. T	July 10, 1879.

First Grade Certificates—Continued.

Name.	Expires.
Stincen, Miss E. E	February 19, 1878.
Stockton, Adelia A	March 26, 1879.
Stone, Henrietta	April 10, 1879.
Sturges, Selden	January 4, 1879.
Sturges, Olive	June 25, 1879.
Swain, Emily	September 22, 1879.
Swain, Orlando E	April 10, 1878.
Swan, Amanda	April 10, 1878.
Sweeney, Timothy Ed	July 10, 1879.
Tanner, Olive D	June 27, 1878.
Taylor, Olivia L	March 8, 1877.
Taylor, Mary A	March 28, 1878.
Taylor, Miss Olivia	April 10, 1878.
Taylor, Catherine	November 7, 1878.
Taylor, Mary F	September 22, 1879.
Thomas, M. Agnes	October 3, 1878.
Thompson, Helena A	May 22, 1878.
Thompson, Miss L	July 10, 1876.
Thompson, J. N	February 3, 1876.
Tierney, Maggie A	March 22, 1877.
Tilton, Etta	March 8, 1877.
Tingley, H. X	October 5, 1876.
Titus, Frank H	January 10, 1878.
Toothaker, Miss M. O	August 28, 1879.
Toothaker, Miss Olivia	November 27, 1876.
Toy, Emma	March 26, 1879.
Tucker, Ida A	October 3, 1878.
Tunnell, Byron J	April 10, 1878.
Turner, Belle J	March 26, 1879.
Tuttle, W. S	August 4, 1877.
Tyler, Ada M	May 22, 1878.
Tyus, Mary A	December 5, 1878.
Valencia, Miss Lydia E	January 20, 1877.
Veroalin, Dempster	July 10, 1879.
Wakefield, Maria M	October 18, 1877.
Walbridge, Jennie M	June 27, 1878.
Waldron, S. A	February 19, 1878.
Wall, Miss Clara	August 29, 1878.
Walker, Christopher	September 22, 1879.
Wallace, Alma	December 5, 1878.
Wallace, George W	January 16, 1878.
Wallace, W. B	November 25, 1875.
Walsh, Miss Nellie E	November 18, 1875.
Walsh, Ida C	September 22, 1879.
Walter, Emlyn	July 18, 1878.

First Grade Certificates—Continued.

Name.	Expires.
Ward, Miss Alice B	September 22, 1879.
Ward, Mary A	May 22, 1878.
Wash, William A	March 28, 1878.
Washburn, Charles E	November 1, 1877.
Watkins, Florence M	March 26, 1879.
Watson, Miss M. H	May 22, 1878.
Watts, Nellie G	July 18, 1878.
Webb, Mrs. M. E. W	May 17, 1879.
Webber, Fred. E	January 20, 1877.
Weeks, Annie C	April 10, 1878.
Weeks, M. L	October 31, 1878.
Weeks, M. L	May 31, 1879.
Weeks, George W	July 10, 1879.
Welch, George Washington	July 10, 1879.
Wells, Addie H	March 24, 1878.
Wells, Alice M	March 26, 1879.
Wenk, Robert E	July 18, 1878.
Wheaton, Miss Clara	April 10, 1879.
Wheeler, Miss Millie	May 13, 1877.
Wheeler, Mrs. J. D	February 2, 1878.
White, Alice M	September 22, 1879.
White, A. F	April 2, 1877.
White, Mrs. Sarah	November 1, 1877.
White, Mattie H	April 10, 1879.
Whitehurst, Thomas W	July 10, 1879.
Whitely, Emma	March 24, 1878.
Whiting, Julia M	March 28, 1878.
Wible, Miss Julia F	January 16, 1876.
Wible, Anna A	March 26, 1879.
Wible, Julia F	March 26, 1879.
Wicks, John T	June 27, 1878.
Wideman, Jas	January 10, 1878.
Wilcox, Miss Celia F	November 27, 1876.
Willmer, John	December 13, 1877.
Wilson, Sarah M	December 13, 1877.
Wilson, H. C	November 25, 1875.
Wilson, Mrs. E. A	April 10, 1879.
Wilson, Mary E	March 26, 1879.
Wilson, William R	March 26, 1879.
Winchester, Mrs. W. H	August 29, 1878.
Withington, Augusta	March 8, 1877.
Wolfe, Mary E. G	July 18, 1878.
Wood, C. T	July 10, 1879.
Woods, Jas. L	January 16, 1876.
Woodward, N. L	March 28, 1878.
Wooll, H. L	October 3, 1878.
Workman, O. P	October 3, 1878.
Wozencraft, W. R	December 13, 1875.

First Grade Certificates—Continued.

Name.	Expires.
Wright, J. M.	April 2, 1877.
Wright, C. C.	November 1, 1877.
Wright, Abby	February 2, 1878.
Young, Nestor A.	February 19, 1878.
Younger, Maggie	July 18, 1878.
Zimmerman, W.	January 22, 1878.

Second Grade Certificates.

Name.	Expires.
Abbott, A. B.	October 18, 1876.
Anderson, Jennie M.	October 18, 1876.
Anderson, Mrs. Emma W.	May 22, 1877.
Anderson, Christina	March 22, 1876.
Andrews, Kate E.	September 22, 1878.
Armor, Mrs. A. L.	April 10, 1878.
Armstrong, Jennie	July 18, 1877.
Auld, Eliza	March 22, 1876.
Babb, Mary A.	January 10, 1877.
Bailey, Lydia A.	January 16, 1878.
Bailey, N. A.	July 10, 1878.
Bainbridge, Mrs. A. C.	July 22, 1876.
Baldwin, Josie E.	July 10, 1878.
Banks, Lizzie	April 10, 1877.
Barey, Eliza E.	October 18, 1876.
Batchelder, Emma F.	September 22, 1878.
Beach, Sarah S.	March 22, 1876.
Bennett, Minnie E.	March 22, 1876.
Berry, Jas. H.	January 10, 1877.
Birdsell, Miss Rebecca	February 11, 1876.
Bixby, Miss E. P.	April 2, 1876.
Blackman, G.	January 16, 1878.
Bodkin, Jno. J.	August 28, 1878.
Bodwell, Etta M.	April 10, 1878.
Bonnard, Helen A.	April 10, 1878.
Booth, Cora	September 22, 1878.
Bowles, J. H (revoked October 23d, 1875)	January 10, 1877.

Second Grade Certificates—Continued.

Name.	Expires.
Boyd, Susie	September 22, 1878.
Bradshaw, Miss Hallie	January 10, 1877.
Brandt, Louise J.	July 10, 1878.
Brett, Jas. Robert	September 22, 1878.
Burscough, Lizzie	January 16, 1878.
Burscough, Lizzie	April 10, 1878.
Butler, Orpha	March 24, 1877.
Cahill, Thos. E.	April 10, 1878.
Campbell, Miss A. E.	October 18, 1876.
Campbell, Kate A.	January 16, 1878.
Campbell, Ruth G.	February 19, 1877.
Carithers, Louise J.	October 31, 1877.
Carpenter, Mattie E.	October 3, 1877.
Cave, Hattie	May 22, 1877.
Chapin, Ida Jessie	September 22, 1878.
Chapman, Aldelbert R.	March 22, 1876.
Child, Lucy E.	January 10, 1877.
Chipman, Lucy	March 22, 1876.
Clapp, Fronie T.	April 10, 1878.
Clark, Robert M.	January 17, 1877.
Clason, C. S.	October 31, 1877.
Clason, Rollo S.	August 4, 1876.
Clawson, Wm. F.	January 16, 1878.
Clearly, Louise E.	March 22, 1876.
Clement, Chas. H.	October 31, 1877.
Cline, Thos. W.	October 31, 1877.
Clow, Amelia B.	May 22, 1877.
Cole, Miss C. A.	April 2, 1876.
Colman, Mrs. D. M.	April 10, 1878.
Congdon, A. R.	February 19, 1877.
Congdon, Miss A. R.	February 11, 1876.
Conners, Mary J.	September 22, 1878.
Cook, Harriet Lavinia	July 10, 1878.
Cooney, Ellen	April 10, 1877.
Coulter, Jas.	June 26, 1878.
Covilland, Chas. J.	April 10, 1877.
Cowie, Annie B.	August 4, 1876.
Crawford, Alonzo	April 10, 1878.
Crawford, Alonzo	January 16, 1878.
Crittenden, J. L.	October 31, 1877.
Dake, Mrs. L. M.	July 22, 1876.
D'Ancona, Miss Charlotte A.	September 22, 1878.
Day, Annie	October 31, 1877.
Deane, Miss K. B.	December 13, 1876.
Dickinson, Marie T.	April 10, 1878.
Donovan, Laura Beven	September 22, 1878.

Second Grade Certificates—Continued.

Name.	Expires.
Dorn, N. A	August 4, 1876.
Dorsey, Miss Mary L	July 10, 1878.
Dudley, Miss Lydia F	September 22, 1878.
Duggan, Amelia	July 18, 1877.
Dunphy, Sallie Powers	September 22, 1878.
Eaton, Effie D	September 22, 1878.
Fagan, Mary	January 16, 1878.
Farguar, C. S	July 10, 1878.
Fay, Mary A	September 22, 1878.
Ford, Mrs. Ella M	September 22, 1878.
Forsyth, Enna D	July 18, 1877.
Fuller, Mary L	August 4, 1876.
Gates, Mrs. Sophia B	April 10, 1878.
Gates, Miss Sophia B	January 16, 1878.
Gibbs, George Jefferson	January 16, 1878.
Gibbs, Cynthia C	March 24, 1877.
Gilmer, Mattie C	July 18, 1877.
Givens, Louise M	March 22, 1876.
Gladding, Miss Lydia H	July 10, 1878.
Goudy, Lizzie	July 18, 1877.
Graffelman, Lucinda	October 31, 1877.
Graham, Estelle E	March 22, 1876.
Graves, John T	July 18, 1877.
Guild, Pacific	March 22, 1876.
Hail, Felix Grundy	September 22, 1878.
Hamilton, Maggie	October 31, 1877.
Hamilton, George	November 7, 1877.
Hankenson, John B	March 13, 1878.
Hanscom, George Tyler	January 16, 1878.
Harrison, Edw. C	July 10, 1878.
Hart, Maria L	March 24, 1877.
Harwood, Miss Clara J	October 31, 1877.
Hayes, E. A	March 22, 1876.
Henderson, W. H	October 18, 1876.
Henderson, Miss M. J	February 19, 1877.
Henry, Libbie S	January 16, 1878.
Hickey, Kate M	October 31, 1877.
Hilton, Stephen	July 10, 1878.
Hinkelbein, Josephine	April 10, 1878.
Hockheimer, Julia	September 22, 1878.
Hopkins, Thomas P	September 22, 1878.
Horton, Willis B	January 10, 1877:
Howe, Mindero Kennedy	September 22, 1878.
Hull, A. J	January 16, 1878.

Second Grade Certificates—Continued.

Name.	Expires.
Hunt, Abbie Louisa	September 22, 1878.
Hunter, Rosa V	January 10, 1877.
Huntley, Miss A. H	July 22, 1876.
Hurley, Mamie E	September 22, 1878.
Jackman, Florence	October 31, 1877.
Jackson, Mrs. J. L	February 19, 1877.
Johnson, Julian W	July 18, 1877.
Johnson, Samuel	January 16, 1878.
Johnston, Lizzie	September 22, 1878.
Jones, Mrs. C. B	July 10, 1878.
Jones, Newman	April 10, 1878.
Jorey, Bessie	October 31, 1877.
Jory, Miss Emma L	October 31, 1877.
Karsky, Miriam	September 22, 1878.
Kendall, Mrs. C. S	July 10, 1878.
Killpatrick, E. C	October 31, 1877.
Knight, D. S	January 10, 1877.
Koen, Mary Ellen	July 10, 1878.
Koper, Miss Mary A	September 22, 1878.
Lande, Miss Jos. E	May 13, 1876.
Leach, Elizabeth S	April 2, 1876.
Leary, Belle S	October 31, 1877.
Lindberg, Emily U	January 20, 1876.
Lipowitz, Mrs. Ellen	July 10, 1878.
Little, Lizzie B	September 22, 1878.
Lloyd, Julius A	July 10, 1878.
Loring, Martha W	September 22, 1878.
Lougnecker, George H	September 22, 1878.
Lowe, Mrs. A	January 10, 1877.
Lowery, Miss Kate M	October 31, 1877.
Lucas, William T	August 4, 1876.
Lucas, M. Ada	September 22, 1878.
Lynch, William Francis	April 10, 1878.
Madden, Jennie Loretta	September 22, 1878.
Mallory, Ida R	July 10, 1878.
Manchester, M. R	April 2, 1876.
Manley, George P	January 17, 1877.
Marshall, George E	October 31, 1877.
Martin, A. E	August 4, 1876.
Martin, Edith J	March 22, 1876.
Martin, Miss Ada	April 10, 1878.
Maurer, Clara F	April 2, 1876.
McCleery, Annie E	October 31, 1877.
McClish, M. Annie	September 22, 1878.

Second Grade Certificates—Continued.

Name.	Expires.
McConnell, Harriet	October 18, 1876.
McDonald, Annie	July 18, 1877.
McFarland, Nellie F	September 22, 1878.
McFarland, Wm	October 31, 1877.
McGeough, Mary V	September 22, 1878.
McGilvray, Mrs. M	July 18, 1877.
McLellan, G. W	July 18, 1877.
McPherson, W. G	August 4, 1876.
Merrill, Mary K	September 22, 1878.
Miles, Mrs. N. Anna	September 22, 1878.
Miller, Minnie E	September 22, 1878.
Miller, Miss C. E	April 10, 1878.
Millett, Libbie W	January 16, 1878.
Miranda, Petra	June 27, 1877.
Morey, Kittie	March 22, 1876.
Morgan, H. J	August 4, 1876.
Morgan, Rose E	October 18, 1876.
Morse, Miss Cora	September 22, 1878.
Morton, Ella Jane	October 31, 1877.
Moses, Hattie A	July 10, 1878.
Moynihan, Nora T	September 22, 1878.
Murphy, Annie L	March 22, 1876.
Nesbitt, Miss J. W	October 31, 1877.
Noritzky, Miss Mena	July 10, 1878.
O'Brien, Rosa H	September 22, 1878.
O'Rourke, Maggie	March 22, 1876.
Ortega, Dario M	August 4, 1876.
Orth, Clara Louisa	July 18, 1877.
Owen, Susie	April 2, 1876.
Paine, George S	January 20, 1876.
Patterson, Isabelle	January 16, 1878.
Patton, Mattie A	September 22, 1878.
Peck, Mrs. Annie Earle	October 31, 1877.
Pedler, Alfred	April 10, 1877.
Peiser, Flora	October 31, 1877.
Phelps, Hannah J	July 18, 1877.
Pitcher, Charlotte	July 18, 1877.
Ray, Carrie L	April 2, 1876.
Ray, Maria	March 22, 1876.
Ray, Maria	April 10, 1878.
Ray, Maria	January 16, 1878.
Reese, Thomas B	October 31, 1877.
Riley, James A	March 22, 1876.
Robbins, Philomene	September 22, 1878.

Second Grade Certificates—Continued.

Name.	Expires.
Roberts, Benjamin F	January 16, 1878.
Robinett, Margretta M	January 16, 1878.
Robinett, Minna	September 22, 1878.
Rockwood, Josephine	January 10, 1878.
Rodahan, B	January 17, 1877.
Rolfe, Eugene	September 22, 1878.
Root, Miss A. M	August 4, 1876.
Root, Ellis	August 4, 1876.
Russell, Ella	March 22, 1876.
Russell, Mary C	April 2, 1876.
Sallee, J. W	January 16, 1878.
Sanborn, Nancy M	July 10, 1878.
Scott, Lillie	September 22, 1878.
Seeley, Miss Nora H	October 18, 1876.
Sharkey, Sarah H	September 22, 1878.
Sheldon, Miss Jennie	February 11, 1876.
Shepherd, Nellie	November 7, 1877.
Shinn, Charles H	July 10, 1878.
Shirley, James W	April 10, 1877.
Shuey, Jewell	April 10, 1877.
Simons, Miss Mary P	April 2, 1876.
Simons, Miss Mary Pearl	September 22, 1878.
Simonton, Miss Sophia A	May 28, 1876.
Simpson, J. M	March 24, 1877.
Smith, Miss M. V	January 20, 1876.
Smith, Miss Ella J	July 10, 1878.
Smith, James	April 10, 1878.
Smith, Juanita J	January 10, 1877.
Spalding, Timothy A	July 10, 1878.
Spencer, Rebecca	June 27, 1877.
Stewart, Jessie M	January 16, 1878.
Stockton, Alice	March 22, 1876.
Stone, O. S	April 10, 1877.
Strange, Miss Emma M	January 16, 1878.
Strawbridge, Miss Viola	May 28, 1876.
Sturtevant, Sarah C	July 10, 1878.
Sullivan, Nora G	January 16, 1878.
Sutherland, Frances	July 18, 1877.
Symonds, Jennie C	April 10, 1877.
Talmadge, Minnie	April 10, 1877.
Taylor, Miss Frankie	January 16, 1878.
Taylor, Thomas G	July 10, 1878.
Tibbitts, Mrs. Elizabeth B	January 16, 1878.
Titus, F. H	August 4, 1876.

Second Grade Certificates—Continued.

Name.	Expires.
Troy, Patrick	February 19, 1877.
Tucker, Mrs. E. R.	April 2, 1876.
Turner, Cynthia M.	April 2, 1876.
Underwood, Mary C.	January 16, 1878.
Voris, Miss Elizabeth M.	July 10, 1878.
Vrooman, Emily M.	January 16, 1878.
Waldron, S. A.	January 10, 1877.
Walsh, Maggie M.	September 22, 1878.
Walsh, Mary T.	September 22, 1878.
Webb, Delia	July 10, 1878.
Weed, Miss Alice	July 22, 1876.
Wetmore, Octavia	September 22, 1878.
Wheeler, Mary E.	September 22, 1878.
Wheelock, Miss E. M.	January 10, 1877.
Whelan, Ella E.	November 7, 1877.
White, Hattie H.	October 18, 1876.
Wickliff, Mrs. Elvira	March 24, 1877.
Wilcox, Katie	September 22, 1878.
Wild, Mrs. Maggie H.	April 10, 1878.
Wing, Florence Delight	August 28, 1878.
Wiseman, Mary L.	September 22, 1878.
Wright, Miss V.	January 10, 1877.
York, John, Jr.	September 22, 1878.
Young, Lenore P.	March 22, 1876.
Zwicker, Katie	September 22, 1878.

Third Grade Certificates.

Name.	Expires.
Adams, Sallie L.	July 18, 1876.
Alrutz, Miss Mary D.	October 31, 1876.
Banks, Lillie	October 31, 1876.
Banks, Lily	April 10, 1877.
Beane, Emma H.	January 16, 1877.

Third Grade Certificates—Continued.

Name.	Expires.
Bills, R. Allie	October 31, 1876.
Blakeslee, Helen S.	October 31, 1876.
Boland, Joanna M. A.	September 22, 1877.
Boyle, Mary Elizabeth	September 22, 1877.
Brady, Theresa B.	July 10, 1877.
Brigham, Henrietta M.	January 16, 1877.
Bronson, Camilla R.	January 16, 1877.
Brooks, Lizzie M.	October 31, 1876.
Brooks, Margaret E.	October 31, 1876.
Bryant, Mrs. Martha L.	October 31, 1876.
Burnell, Electa J.	January 16, 1877.
Burscough, Lizzie	October 31, 1876.
Caldwell, Sarah	September 22, 1877.
Campbell, Kate A.	May 22, 1876.
Chapman, Miss F. L.	March 24, 1876.
Charte, Christine	September 22, 1877.
Chesnutwood, Lizzie H.	April 10, 1877.
Clark, Mrs. Hattie	October 31, 1876.
Classen, Louise M.	October 31, 1876.
Clow, Mary B.	May 22, 1876.
Colby, Phebe S.	April 10, 1876.
Cornell, Sadie	July 10, 1877.
Cuffe, Frances A.	July 10, 1877.
Davis, Miss Dora	January 10, 1876.
Dicker, Meda L.	January 10, 1876.
Donnelly, Louisa	October 31, 1876.
Donnelly, Louisa	January 16, 1877.
Ellis, Carrie M.	January 16, 1877.
Ephraim, Janette	January 16, 1877.
Fagan, Mary	October 31, 1876.
Fleming, Mary A.	October 31, 1876.
Gavigan, Annie E.	July 10, 1877.
Gilbert, Mrs. Henry D.	October 31, 1876.
Gillam, Miss Sallie	September 22, 1877.
Gilman, Lucie A.	April 10, 1877.
Glidden, Flora A.	January 16, 1877.
Hagen, Miss Louise C.	February 19, 1876.
Haslam, Susie E.	April 10, 1877.
Hawley, Clara M.	October 31, 1876.
Heney, Libbie S.	October 31, 1876.
Hulett, Eva M.	April 10, 1876.
Hull, Lottie J.	January 16, 1877.

Third Grade Certificates—Continued.

Name.	Expires.
Jacobs, Cecelia	July 10, 1877.
Jehn, Marian	January 16, 1877.
Jewett, Mary Julia	July 10, 1877.
Johnson, Marie J	September 22, 1877.
Kerr, Miss Margaret	January 16, 1877.
Kervan, Lulu K	September 22, 1877.
Kirby, Miss Ora	January 10, 1876.
Kraus, Emma F	January 16, 1877.
Kroff, Sophie	July 18, 1876.
Leever, Miss E. L.	January 10, 1876.
Levy, Hattie	January 16, 1877.
Lovejoy, Mrs. Belle	January 16, 1877.
Madden, Jennie L	October 31, 1876.
Madden, Jennie L.	January 16, 1877.
Madden, Jennie L	April 10, 1877.
Mansfield, Anna Adams	January 16, 1877.
Mason, Cannie	September 22, 1877.
Mathews, Addie	July 10, 1877.
McLean, Anna M.	July 10, 1877.
McNevin, Maggie A	July 10, 1877.
Moore, Sallie V	October 31, 1876.
Morse, Winora E	October 31, 1876.
Moyle, Louise E	September 22, 1877.
Mulgrew, Cassie A	April 10, 1876.
Mulgrew, Mary Jane	April 10, 1876.
Murphy, Miss Nellie	January 16, 1877.
Murphy, Miss Nellie	April 10, 1877.
North, E. M	July 10, 1877.
Norton, Cora	January 10, 1876.
O'Brien, Annie M	September 22, 1877.
O'Donnell, Sarah F	January 16, 1877.
Paulk, Miss U. A	January 10, 1876.
Patchet, V	November 1, 1875.
Peck, Helen E	July 10, 1877.
Pelham, Mrs. Mary E	January 16, 1877.
Phelps, Mrs. Eliza T	July 18, 1876.
Richardson, Irene	April 10, 1877.
Russell, Zadie E	September 22, 1877.
Salsig, Alice A	April 10, 1877.
Saxton, Mary L	October 31, 1876.

Third Grade Certificates—Continued.

Name.	Expires.
Shaw, Ella B	July 18, 1876.
Shea, Mary T	September 22, 1877.
Sherman, Miss Julia E	April 10, 1877.
Simon, Malvina	January 16, 1877.
Smith, Belle	April 10, 1877.
Smith, Lillie W	January 16, 1877.
Starkweather, Clara E	January 16, 1877.
Strauss, Ida	October 31, 1876.
Sullivan, Nellie	January 16, 1877.
Summerfield, Alice	April 10, 1876.
Summers, Miss S. G	January 10, 1876.
Swain, Emily F	October 31, 1876.
Thompson, Miss Ettie L	July 10, 1877.
Thompson, Sadie R	January 16, 1877.
Tiedeman, Dora	July 10, 1877.
Trimble, Caroline	April 10, 1877.
Vallean, Sophie	January 16, 1877.
Vallean, Sophie	April 10, 1877.
Vallean, Sophie	July 10, 1877.
Walton, Miss Addie E	October 31, 1876.
Whitehouse, Hattie E	September 22, 1877.
Willard, Robub	July 10, 1877.
Wood, Evelyn E	September 22, 1877.
Wood, Miss Susie M	October 31, 1876.

UNIVERSITY OF CALIFORNIA.

1. COLLEGES IN THE UNIVERSITY.
2. REQUIREMENTS FOR ENTRANCE.
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4. OUTLINE OF THE INSTRUCTIONS GIVEN IN THE DIFFERENT BRANCHES OF STUDY.
5. THE SCIENTIFIC DEPARTMENTS.
6. COLLEGE OF AGRICULTURE.
7. COLLEGE OF MECHANICS.
8. COLLEGE OF MINES.
9. COLLEGE OF ENGINEERING.
10. COLLEGE OF CHEMISTRY.
11. COLLEGE OF LETTERS.
12. COLLEGE OF MEDICINE.
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15. GENERAL EDUCATIONAL MATTERS.

BIENNIAL REPORT

OF THE

REGENTS OF THE UNIVERSITY OF CALIFORNIA,

FOR THE YEARS 1873-5.

I.—COLLEGES IN THE UNIVERSITY.

The University embraces seven courses of study, commonly called "Colleges;" namely:

In Science: Agriculture, Mechanics, Engineering, Chemistry, Mining, and Medicine. (1)

In Letters: Classical, and Literary.

For the colleges in science, as well as for the Literary course in the College of Letters, the degree given at the close of the course is that of Bachelor of Philosophy. For the Classical Course, the degree is that of Bachelor of Arts; in the Medical College, the degree is Doctor of Medicine.

The Scientific Courses correspond very closely with the modern courses established in the institutions of other States which received the Congressional grant of eighteen hundred and sixty-two. They are intended to give the student a good preparation for the pursuits of Agriculture, Mining, Engineering, Mechanics, and Chemistry. The studies of the first two years are very nearly the same in all these Colleges. In the last two years the special studies predominate.

The Literary Course is based upon History and the general scientific studies, including Mathematics, Physics, Chemistry, Geology, etc; Modern Languages, including Anglo-Saxon, English, French, and German, with the option of others.

The Classical Course corresponds closely with that of Classical Colleges at the East.

(1.) The College of Medicine is in San Francisco; it is under a separate Faculty, and is self-supporting.

The California College of Pharmacy has been affiliated with the University, retaining its own organization.

Neither of these Colleges receive any part of the State appropriations, though a small amount for repairs on the Medical College building has been paid by the Regents.

II.—GENERAL REQUIREMENTS.

Candidates for admission are in all cases expected to be not less than sixteen years of age, and to bring with them testimonials from their teachers or other responsible persons. They are examined in Arithmetic, Algebra (to equations of the second degree), and Geometry (four books of Legendre), and in the elements of "a good English education," as that phrase is commonly understood. If they intend to enter the Literary Course, a knowledge of Latin is very desirable, and after the examination of eighteen hundred and seventy-five it will be required. If they intend to enter the Classical Course, the examination is extended to the studies of Latin and Greek. All these requirements are more fully explained in subsequent paragraphs.

The Faculty are sometimes urged to receive students who are younger than sixteen years of age, but who have the requisite knowledge. The reason for declining to do so is this: that the course of study here prescribed is difficult, and demands not merely elementary knowledge, but also a certain maturity or strength of mind and purpose, more or less dependent upon years. If the candidate can do more than master the prescribed requisites for admission, he may well direct his attention to the study of French, German, Latin, or some other language; or he may take up some branch of Natural History, which will train his powers of observation and classification (like the local Botany, Mineralogy, Entomology, Ornithology, etc.), and will also help his physical development, by the field work and out-of-door study; or he may carry his mathematical studies farther on; or endeavor to become proficient in accurate, truthful drawing, or pursue a wider course of historical reading. In short, the more a scholar brings with him to college, the more profit he will derive from the studies of his course.

Students are sometimes received as students in special courses. They are expected to be older and more proficient than those who enter the Freshman Class, and, besides, are expected to give some reason satisfactory to the Faculty for choosing the special studies which they may select. In other words, the University does not recommend any deviation from a regular course, unless the tastes, the age, and the previous studies of the scholar make it probable that the special course will receive earnest attention. In the Chemical Laboratory students are thus received. Ladies sometimes attend only the instructions in literary or scientific studies. Occasionally there are good reasons why a partial course is followed; but "special students" do not ordinarily aim at an academic degree, and their education, so far as the University is concerned, is less symmetrical than that of the regular students.

Many applicants for admission are unable to enter the University on account of their inability to pass the requisite examination, through *imperfect preparation.*

It is impossible to urge too strongly upon parents, teachers, and pupils the inevitable hindrance and embarrassment, and often absolute failure, caused by coming here imperfectly prepared. Teachers do a great injury to their pupils if they allow them to suppose their preparation sufficient, when a careful study of the information afforded by the University might assure them that it is far from being so.

It is no kindness to a young person, but rather an irreparable harm, if he is permitted to enter the University so imperfectly prepared that

he can only fail, when another year of study, or better advantages in the way of preparatory instruction, would enable him to succeed.

III.—ENGLISH REQUIREMENTS.

Candidates for admission to any College, are required to show a thorough acquaintance with the elements of Geography (both political and physical), of Grammar (both theoretical and practical), and of United States History. They must also have learned well the fundamental matters pertaining to practical composition (including penmanship, spelling, and punctuation), and reading aloud, intelligently and intelligibly, any ordinary English.

Geography.—With regard to Geography, the candidate is required, not only to name and to locate the principal mountains, rivers, countries, etc., but also to show an intelligent knowledge of them. That is to say, he must understand the physical peculiarities of the various regions, with the results to man in occupations and products; the aspects of different lands, climates, and peoples; their forms of government and religion; their relations to us, through commerce, immigration, etc. In other words, not only geographical names must have been learned, but the things themselves must have been inquired about and reflected on. Candidates have sometimes shown a lamentable ignorance of the whole subject of physical geography. No part of the subject is more important, or more indispensable to further progress.

History.—The candidate is expected to show a familiar acquaintance with the chief events of American history, such as may be derived from the careful study of any one of the common school books on this subject. Some of the most important dates should, of course, be learned, but the chief effort of the scholar should be to understand the course of events which has marked the progress of this country, and to appreciate the influence of the principal historical characters.

Grammar.—In Grammar, it is by no means sufficient to repeat the names, phrases, and rules. The candidate must have learned them intelligently. He is required to define each division of each part of speech, with copious examples, showing a distinct idea of the functions of each; as well as to explain the relations between the parts of sentences. This is tested by his ability to use correctly all the parts of speech, in their different moods, tenses, cases, etc., in variously constructed sentences of his own. It is recommended that pupils practice the old-fashioned method of analyzing and parsing various passages of standard prose and verse, so as to unfold their precise meaning. But in this, as in all exercises, pupils are earnestly warned against mere rote-learning, or the mechanical repetition of words and phrases which are not distinctly conceived and understood. Such "learning" is not only of no value, but gives an examiner a most unfavorable opinion of the candidate's fitness to go on with higher studies.

Composition.—In Composition, the candidate must have gained by practice the ability to state any simple thing he knows, or has seen, or thought, in plain English, clearly and correctly; and with due regard to legible penmanship, to spelling, and to punctuation. At the examination of eighteen hundred and seventy-four, each candidate was required to write a composition, on a simple subject given by the examiners; and in future still more stress will be laid on this requirement.

Reading.—In Reading there is required a distinct articulation of each

vowel and consonant of our alphabet, and an ability to read so as to show an intelligent apprehension of the meaning of what is read.

IV.—MATHEMATICAL REQUIREMENTS.

Arithmetic.—A thorough and sound knowledge of the arithmetic is requisite on the part of candidates.

They must be thoroughly versed in the principles of fractions, both common and decimal; skillful in the resolution of numbers into their prime factors, and able promptly to find the least common multiple and greatest common divisor of two or more numbers. They must be familiar with percentage and the various applications thereof, and the principles of proportion, and must have been well-taught in the French Tables of weights and measures; *i. e.*, the Metric System.

In *Algebra*, the candidate must have advanced as far as equations of the second degree in the Higher or University edition of some good author; and he must have mastered the principles of *Geometry* to an extent equivalent to the first four books of Davies' Legendre. But while it will be seen that the quantity of mathematical preparation is small, it is expected that the quality of it shall be of the best description.

The candidate must be able not merely to perform the exactions set before him, and to get the correct answers to examples, but to explain the principles by which he has operated, and to make that explanation in a clear and intelligent manner.

It is hoped, and confidently expected, that the facilities for good preparation will be such in the different parts of California, that the standard of these requirements can be considerably elevated at an early day in the future.

V.—CLASSICAL REQUIREMENTS.

Candidates for admission to the Classical Course must pass the same examinations as are necessary for the College of Science. In addition, there are the following requisitions in Latin and Greek:

Latin Grammar, including Prosody; Cæsar, four books; Cicero, six orations; Virgil's Eclogues, and six books of the Æneid. After eighteen hundred and seventy-five, there will also be required the Georgics of Virgil, and twenty-six lessons of Allen's Latin Composition.

Greek Grammar, including Prosody; Xenophon's Anabasis, three books; Homer's Iliad, two books (omitting the catalogue of ships.) After eighteen hundred and seventy-five, the requisition in the Anabasis will be increased to four books, or their equivalent in the Greek Reader. There will also be an examination in Jones' Greek Composition.

Also, that points in history, biography, and geography be carefully studied, in connection with the reading lessons.

Also, that derivations be constantly noted, especially of such Greek and Latin words as have come into English.

VI.—OPTIONAL STUDIES.

Students already proficient in the studies laid down in the general scheme which they are following, or who have sufficient extra time at their disposal, may pursue optional studies, with the permission of the Faculty; or they may attend lectures and exercises appointed for other

sections of the University, if it does not conflict with their regular appointments.

EXAMINATIONS.

In all the courses of the University, the instruction, whether by lectures or text-books, is accompanied by daily examinations.

Term examinations are held at the close of the first term on the studies of the term. These examinations are either in writing or oral, according to the nature of the study.

Annual examinations are held at the close of each academic year. They cover the ground gone over during the year, and the four thus held constitute the examination for a degree. These examinations are chiefly in writing.

The credits for the term and annual examinations are combined with the student's daily credits, to make up the record of the term and the year.

Examinations for Degrees.—For students passing through the University these examinations are annual, as stated above, and there is no other examination covering the whole course. The law also provides such a general examination for those who have studied elsewhere.

"Students who shall have passed not less than a full year as resident students in any college, academy, or school in this State, and, after examination by the respective Faculty of such college, academy, or school, are recommended by such Faculty as proficient candidates for any degree in any regular course of the University, shall be entitled to be examined therefor at the annual examination; and on passing such examination shall receive such degree for that course, and the diploma of the University therefor, and shall rank and be considered in all respects as graduates of the University.

"All students of the University who have been resident students thereof for not less than one year, and all graduates of the University in any course, may present themselves for examination in any other course or courses, at the annual examinations, and, on passing such examination, shall receive the degree and diploma of that course."

GRADUATING THESES.

As a part of the final examination for degrees, every candidate is required to prepare a thesis upon a subject closely related to his principal course of study.

Selections from the thesis are publicly read, in the presence of the Faculty and the class, upon appointed days. The length of the essay is not so much regarded as the intellectual vigor which it shows, and the mode in which the thoughts are expressed. For example, a chemical analysis; a problem in engineering, physics, or mechanics; an agricultural investigation; a literary criticism; an historical, ethical, or philological study, may be presented, according to the special pursuits and tastes of the writer; and the estimate of the Faculty does not depend upon the number of pages submitted, but on the amount of thought and care evinced by the work.

The object of this regulation is to encourage special original investigations upon important themes growing out of or suggested by the

several courses of study pursued in the University, and to afford a good opportunity for stating, in a clear and definite style, the results of such researches.

NUMBER OF STUDENTS.

SUMMARY.

(Not including the Students in Medicine.)

Whole number		237
Young men	197	
Young ladies	40	

I.—ARRANGED BY COURSES.

Post-Graduates	9
Candidates for the Bachelor's Degree	171
Students at Large	19
Special Course Students	38
Total	237

II.—ARRANGED BY COLLEGES.

Students in the five Colleges of Science		96
Students in the College of Letters:		
Classical	50	
Literary	26	
		76
Students at Large and Special		56
Students post-graduate		9
Total		237

The Students in the Scientific Colleges are not required to announce the special College (*i. e.*, Agriculture, Mechanics, Mining, Chemistry, or Engineering), they choose to enter, until the end of the second year.

III.—ARRANGED BY CLASSES.

	Science.	Letters.	Total.
Senior, or First Class	14	9	23
Junior, or Second Class	18	20	38
Sophomore, or Third Class	24	7	31
Freshman, or Fourth Class	40	40	80
Totals	96	76	172
Not assigned to classes			65
Total			237

NOTE.—Some of the Students at Large, and of the Special Course Students, are pursuing nearly full courses in connection with some one of the Colleges. Some of these expect to become candidates for a Degree.

There is no Preparatory Class.

INCREASE IN NUMBER OF STUDENTS.

The number of students has steadily increased since the University was opened, as follows:

Years.	Science.	Letters.	Special and at Large.*	Total.	Ladies.
1869–70	14	21	5	40	...
1870–71	28	24	26	78	8
1871–72	75	28	50	153	27
1872–73	93	44	48	185	39
1873–74	100	44	47	191	22
1874–75	96	76	65	237	40

* Including 1873–4, two, and in 1874–5, nine, post-graduates.

NOTE.—Since tabulating the foregoing statements, the catalogue of the Freshman Class—eighteen hundred and seventy-five-six—has been made up. The list shows one hundred and fifty-three, of which eleven are young ladies.

Classical	21	
Literary	51	
		72
Scientific		81
Total		153
Add to the above the students in other classes, as heretofore stated, less the graduates of 1875, who numbered 24, and it leaves		223
Total number of students now attending the University		366
Increase, when compared with previous year		129

The three hundred and sixty-six students, as above, may be classed as follows:

Classical and Literary	139
Scientific	162
Special, or not assigned to classes	65
Total	366

OUTLINE OF THE INSTRUCTIONS GIVEN IN THE DIFFERENT BRANCHES OF STUDY.

MATHEMATICS.

Freshman Class—Algebra: Solution of Equations, first and second degrees; Binomial Theorem; Extraction of Roots of any degree, both of numbers and algebraic quantities; Operations on radicals of any degree, and upon quantities affected with fractional and negative exponents; Progressions and Proportions; Principle of Indeterminate Coefficients; Summation of Series by the method of Differences, and by special methods; Solution of Exponential Equations; Theory of Logarithms; General Theory of Equations; different methods of Solving Numerical Equations of any degree. TEXT-BOOK: Davies' Bourdon.

Geometry.—Instructions in Plane Geometry; Geometry of Three Dimensions, and Spherical Geometry; Exercises in Geometrical Invention; Loci; Symmetry; Maxima and Minima by Geometrical Methods; Harmonic Proportion and Harmonic Pencils; Polars, Centers of Similitude, etc. TEXT-BOOK: Olney's Geometry.

Sophomore Class.—Trigonometry and Mensuration.—Thorough practical instruction in the use of Tables of Logarithms, and Logarithmic Functions, Plane and Analytical Trigonometry; Spherical Trigonometry, and Mensuration. TEXT-BOOK: Olney's Trigonometry.

Analytical Geometry.—Determinate and Indeterminate Geometry, including a full Examination of the Properties of the Conic Sections. TEXT-BOOK: Church's Analytical Geometry.

Descriptive Geometry; Spherical Projections; Shades, Shadows, and Linear Perspective. TEXT-BOOK: Church's Descriptive Geometry.

Junior Class.—Differential and Integral Calculus; and the Calculus of Variations. TEXT-BOOK: Church's Calculus.

In the Colleges of Letters, Agriculture, and Chemistry, one Term is devoted to the study of Surveying. TEXT-BOOK: Murray's Manual of Surveying.

PHYSICS AND MECHANICS.

The course of instruction in PHYSICS and MECHANICS commences with the Second, or Sophomore Year of the regular course, and is completed in three years.

The Students in the Sophomore Class are occupied with the subject of HEAT: including Thermometry; Laws of Expansion of Solids, Liquids, and Gases; Laws of Conduction and Convection; Laws of Liquefaction and Solidification; Laws of Ebullition; Laws of Elastic Force of Vapors; Theory of Steam Engine; Laws of Vaporization and Condensation; Spontaneous Evaporation; Hygometry; Laws of Specific Heat; Sources of Heat; Mechanical Equivalent of Heat; Heat of Combustion; Dynamical Theory of Heat.

Then commences the course on MECHANICS: embracing general Properties of Matter; Measurement and Representation of Forces; Momentum; Uniform Motion; Uniformly Accelerated and Retarded Motion; Laws of Motion; Composition, Resolution, and Equilibrium of Forces; Composition and Resolution of Motions and Rotations; Principle of Moments; Theory of Parallel Forces; Theory of Couples; Curvilinear Motion, and the Laws of Centrifugal Force.

The students in the Junior Class continue the study of MECHANICS: including Laws of Gravity; Laws of Central Forces; Laws of Falling Bodies; Application of Theory of Parallel Forces to Center of Gravity and Stability; Elementary Machines and Theory of Machinery; Laws of Friction and Resistance to Motion; General Theorem of Work; Maximum Effect of Machines and Animals; Motion on Inclined Planes; Vibratory Motion; Theory of Pendulum and Applications; Laws of Impact; Moment of Inertia; Theory of Projectiles and Application to Gunnery. MECHANICS OF LIQUIDS: including Transmission of Pressure; Pressure due to Weight; Buoyancy and Flotation; Application to Specific Gravity. Motion of Liquids: Spouting Liquids; Motion of Water in Pipes, Canals, and Rivers; Theory of Water Motors, and the Power of the various kinds of Water Wheels. MECHANICS OF GASES: including Laws of Compressibility and Elasticity; Pressure of the Atmosphere; Barometric Formula; Applications to Pumps, Siphons, Fire Engines, etc.; Theory of Resistance of Fluids; Mechanics of Capillarity. ELECTRICITY: including Laws of Electrical Action; Distribution of Electricity; Electrical Induction; Theory of Dielectric Induction; Theory of Leyden Jar and Electric Battery; Electric Light; Mechanical and Chemical Effects of Electricity; Cause of Electrical Phenomena; Atmospheric Electricity; Thunder Storms; Lightning-rods. MAGNETISM: embracing Laws of Magnetic Forces; Terrestrial Magnetism; Declination, Variation, and Dip of the Magnetic Needle; Diamagnetism. ELECTRO-MAGNETISM: including Fundamental Laws of Electro-Dynamics; Power of Electro-Magnets; Electro-Dynamic Induction; Magneto-Electricity; Theory of Induction-Coil; Thermo-Electricity; Law of Ohm; Economy of Electric Motors; and Theory of Electric Telegraph.

Students of the Senior Class are occupied with Undulations and Wave Motion. ACOUSTICS: Including Propagation of Sound and Elastic Waves; Reflection, Refraction, and Interference of Sounds; Physical Theory of Music. OPTICS: Embracing Theories of Propagation of Light; Velocity of Light; Photometry; Laws of Reflection and Refraction; Dispersion of Light; Spectroscope; Theory of Rainbows and Halos; Interference of Light; Diffraction; Polarization of Light; Theory of Vision; Theory of Optical Instruments.

The method of instruction is by means of Lectures and Recitations, accompanied by experimental demonstrations and the solution of practical problems.

The Cabinet of Physical Apparatus is very complete, and many additions have been made to it since the last report.

Text-book: Snell's edition of "Olmsted's Natural Philosophy." Recommended for reference: Atkinson's edition of Ganot's Physics; Lardner's "Hand-Book of Natural Philosophy;" Silliman's "Principles of Physics;" Peck's Mechanics.

GEOLOGY AND NATURAL HISTORY.

The course of lectures in this department commences in the Sophomore Class, with Botany. In the First Term, Structural Botany is taken up; and in the Second Term, the Physiology of Vegetable Growth and Reproduction, and the Principles of the Classification of Plants. The course is fully illustrated by the use of the microscope. Text-book: Gray's "Structural and Systematic Botany."

Zoölogy is commenced in this class.

Zoölogy commenced in the previous class is continued through the Junior year. The course includes Comparative Anatomy and Physiology of Animals, and the Principles of Classification. The microscope is used to illustrate the course. Text-books: Agassiz's "Principles of Zoölogy." References: Carpenter's "Zoölogy;" Milne Edward's "Manual of Zoölogy;" Todd's "Cyclopedia of Anatomy and Physiology," etc.

Geology is taken up in the Second or Junior Class. The lectures are confined to Dynamical Geology, or the study of the various agencies now at work modifying the earth's surface and producing structure. Under this general head are taken up Atmospheric Agencies, River Agencies, Glacial Agencies, Ocean Agencies, Igneous Agencies, Organic Agencies, etc.

Geology, commenced in the previous class, is continued in the Senior Class. The First Term is occupied with Structural Geology; the General Structure of the Earth; the Structure and Position of Rocks; the Formation and Distribution of Fossils; the Occurrence and Origin of Mineral Veins; the Structure and Mode of Formation of Mountain Chains, etc. The later instructions are devoted to the History of the Earth. This history will be illustrated principally from American Geology, and, as far as possible, from the Geology of the State. Throughout the course, attention is devoted to points of special interest, scientific or practical. The course is thoroughly illustrated by the use of an ample museum of rocks, ores, and fossils, and an extensive collection of Ward's Geological Casts.

References: Dana's "Manual of Geology;" Lyell's "Principles of Geology," Lyell's "Elements of Geology;" De la Beche's "Geological Observer;" Juke's "Manual of Geology."

CHEMISTRY.

Instruction is given in general and theoretical chemistry by lectures, recitations, and laboratory practice. This course extends through three terms, one in Freshman year and two in Sophomore year, and embraces the elements of inorganic and organic chemistry. Students, after making themselves familiar with the details of experiments, are required to repeat the same in the laboratory for elementary chemistry.

An advanced course of lectures is given to students of the Junior and Senior Classes, in general and theoretical chemistry. This course embraces a discussion of the general principles of the science and their application to analytical and metallurgical chemistry, and to mineralogy.

The chemical laboratories are open daily for instruction in analytical chemistry.

The course of instruction in qualitative analysis includes the analysis of simple and complex substances in the wet way, their analysis by the use of the blow-pipe and flame reactions, and the determination of minerals with the blow-pipe. Students are required to keep a careful record of their work, and to submit the same to the inspection of the Professor. Upon passing a satisfactory examination in qualitative analysis, students can pass to the quantitative laboratory.

In the quantitative laboratory instructions are given in the quantitative gravimetric analysis of simple and complex salts, minerals, ashes of plants, mineral waters, etc.; in volumetric analysis, including acidimetry, alkalimetry, clorimetry, etc.; in organic analyses; in gas analysis; in the preparation from inorganic and organic compounds; and in the carrying out of original investigations.

Students taking the course of chemistry are expected to spend at least fifteen hours a week in the laboratory during Junior year, and twenty hours a week during Senior year.

Students who, for satisfactory reasons, do not wish to take the full course, may enroll themselves with the Professor of Chemistry as special students. Students wishing to take a post-graduate course will find an abundant opportunity for pursuing their studies.

CIVIL ENGINEERING.

Instruction in this branch is given by recitations, lectures, use of text-books, and works of reference, illustrative models, diagrams, maps, etc., and the consideration of existing structures and working plans

Topographical drawing, in ink and in colors, is taught in connection with this branch; as also structural drawing.

A prize of fifty dollars was given by the Professor of Engineering, to that member of the Graduating Class of eighteen hundred and seventy-five who exhibited the greatest proficiency in the engineering studies of his class.

The text-books used are Gillespie's Surveying, and Roads and Railroads; Mahan's Fortifications and Stone Cutting; Henk's Field Book; Wood's Resistance of Materials, and Bridges and Roofs.

For reference, Gillespie's Land Surveying, "Simm's Instruments," Frome's Trigonometrical Surveying, Reports of the United States Coast Survey, Reports of the United States Engineer Corps, their Professional Papers, etc., "The Plane Table," as used by the United States Coast Survey, "Smith's" and "Enthoffer's" Topographical Drawing, Rankine's Civil Engineering, and Applied Mechanics; Weisbach's Mechanics and Engineering; Moseley's Mechanics of Engineering.

A post-graduate course of two years length, embracing the higher subjects of engineering study, leads to the degree of Civil Engineer. (C. E.)

INDUSTRIAL DRAWING.

Third Class.

First Term.—Construction of geometrical problems relating to points, lines, circles, and polygons, and drawing of combinations of these problems to give practice in the use of instruments.

Second Term.—Drawing of problems in Descriptive Geometry, following the course given in this branch; practice in lettering for maps.

Second Class.

First Term.—Application of Descriptive Geometry to constructions of the Civil and Mechanical Engineer. Platting of field notes in surveying and leveling and mapping, following the course in Civil Engineering.

Second Term.—Application of Descriptive Geometry continued, with shades and shadows. Platting of road and railroad work, earth work, etc., following the course.

First Class.

First Term.—Construction of simple machines, screws, helical surfaces, teeth of wheels, gearing, etc.; examples of stonecutting and masonry constructions.

Second Term.—Drawing of steam engines and machines, etc.; drawing of joints, framing bridges, roofs, etc., following the course.

Instruction is also given in free-hand drawing.

ASTRONOMY.

Instruction in Astronomy to Engineering Students extends through both terms of the Senior year.

It is given by means of recitations, lectures, and the use of text-books and works of reference, globes, charts, etc.

During the first term Norton's Astronomy, to Chapter XV, is completed. In the second term the course includes the subject of Practical Astronomy. In the third term the more important of the problems of Practical Astronomy are solved, and the theory and use of astronomical instruments are discussed.

Special instruction in the use of astronomical instruments is given by Professor Davidson, of the United States Coast Survey.

Works of Reference: Woodhouse's, Herschel's, Brunnow's, Guillemin's, Loomis' Practical Astronomies; American and English Ephemeris, etc.

ENGLISH.

The study of English falls naturally into three divisions, which have, nevertheless, a most intimate and constant connection, viz: 1. The study of the Language, in its structure and history. 2. The study of the Literature, both in its past monuments, and in its current progress. 3. The attainment of practical skill in its use, or what may be included under Composition, Rhetoric, and Criticism.

During the whole four years, these studies go hand in hand, constantly helping each other to a higher development. The course in each may, however, be seen separately, as follows:

English Language.

In FRESHMAN year, the First Term is occupied with a general view of the history and structure of the language. The Text-book is Hadley's "Brief History of the English Language." For Reference, are recommended: Webster's or Worcester's "Unabridged Dictionary;" Bain's "English Grammar;" Earle's "Philology of the English Tongue;" Corson's "Handbook of Anglo Saxon and Early English;" Marsh's "Lectures on the English Language;" Trench's "Study of Words," and "English Past and Present;" Edith Thompson's "History of England;" Freeman's "Norman Conquest."

In the Second Term there are given in the Classical and Literary Courses, Lectures on the Indebtedness of English to Latin and Greek. To the whole class are given Lectures on Authors, with regard to language and style. For Reference, the student's attention is directed to such works as Chaucer, Shakspeare, Bacon, Milton, Addison, DeQuincey, Emerson, Longfellow, Tennyson, Herbert Spencer, the New York Nation, and other contemporary periodicals.

In SOPHOMORE year, the First Term includes a more minute study of the history and structure of the language. The Text-book is Earle's "Philology of the English Tongue." For Reference are recommended: Maetzner's "English Grammar;" Whitney's Lectures; March's "Compar. Gram. of Anglo-Saxon;" Ellis' "Early English Pronunciation;" Morris' "Outlines of English Accidence;" Whitney's "German Grammar;" Otto's or Duffet's "French Grammar."

In the Second Term, some of the chief literary monuments are critically studied. The Text-book is Sprague's "English Masterpieces." For Reference are recommended: "Studies in the English of Bunyan;" White's "Shakspeare;" Craik's "English of Shakspeare;" Carpenter's "English of the Fourteenth Century;" Standard Authors.

In JUNIOR year the whole class continue the study of the language, in connection with English Literature and Composition. (See under those heads.)

Juniors in the Literary Course take up, in the First Term, the minute and comparative study of Anglo-Saxon Grammar. The Text-book is March's "Compar. Grammar of Anglo-Saxon." For Reference are recommended Koch's "Englische Grammatik;" Heyne's "Laut- & Flexionslehre;" Allen & Greenough's "Latin Grammar;" Goodwin's "Greek Grammar;" Latham's "English Language."

The Second Term of the Literary Course includes the study of Anglo-Saxon and Early English Texts. The Text-book is Corson's "Handbook of Anglo-Saxon and Early English." For Reference are recommended: Ettmüller's "Lexicon Anglo-Saxonicum;" Green's "Bibliothek der Angelsächsischen Poesie;" Thorp's "Anglo Saxon Chronicle;" Madden's "Layamon's Brut;" Bohn's "Pauli's Life of Alfred the Great;" Early English Text Soc. Publications.

In SENIOR year, First Term, the Classical and Literary Courses include the study of Whitney's "Language and the Study of Language." Accompanying this study, a course of lectures on Language is given to the whole class. For Reference, they are directed to such writers on Philology as Whitney, Hadley, Marsh, and Max Müller, and to standard literature, including the best periodicals.

English Literature.

In FRESHMAN year, during both the First and Second Terms, the attention of the class is called to some of the best English writers, in connection with Composition Exercises. (See under that head.)

In the Second Term, also, there are lectures on Authors. (See under the head of English Language.)

In SOPHOMORE year, in the course of the First Term, there are lectures on the Library and Library Work.

In the Second Term, the study of English Masterpieces is commenced. (See under the head of English Language.) The Composition Exercises of this term, also, include the account of books read. (See under the head of Composition and Rhetoric.)

In JUNIOR year, the study of English Literature is pursued by the whole class during the entire year. The Text-book is Taine's "History of English Literature." For Reference are recommended: Craik's "English Literature;" Morley's "English Writers," and "Tables;" Shaw's "English Literature," (new edition: Schermerhorn); Coppee's "English Literature;" Whipple's "Literature of the Age of Elizabeth;"

Lowell's "My Study Windows;" and, especially, eminent authors in their complete works.

During the Second Term, also, Essays are written by the whole class, on authors and their times. (See under the head of Composition and Rhetoric.)

In the Literary course of the Junior year, the biographies of famous writers are investigated, and their works studied, in connection with written essays. (See under the head of Composition and Rhetoric.) Our indebtedness to the literature of other languages is investigated.

In the SENIOR year, the whole class have lectures on General Literature.

In the Literary Course there are, during the year, Essays and Lectures on the Literary Art; The Man of Letters; Fiction, and the Novelists; History, and the Historians; Poetry, and the Poets; Criticism, and the Reviews; Journalism, and the Newspapers.

English Composition and Rhetoric.

Practice in writing is continued through the entire four years. At first the simpler styles are used, and attention is given to those fundamental matters which are essential to all composition. More and more, as the course develops, the composition is made to serve other ends of scholarly and literary culture, as well.

In FRESHMAN year, for the First Term, the subjects are confined to Objective Description and Narration. The purpose is to have the student gain the power and the habit of close, accurate observation, and the clear, truthful statement of its product. In the Second Term, a Text-book, Whateley's "Rhetoric," is used, and the subjects embrace Exposition and Argument. Written Translations, in the Classical Course, are an important aid to expression.

In SOPHOMORE year, the First Term includes further practice in Exposition and Argument, united, as well as Imaginative Description and Narration. In the Second Term the compositions give Accounts of Books Read, and the Results of Investigations in English and American History.

In JUNIOR year, First Term, students in the Literary Course write Descriptive Sketches (in prose or verse), and the result of Investigations in Literary Biography. In the Second Term the whole class write Accounts of Authors Read, or Subjects Investigated (chiefly in connection with literary history). The members of the Literary Course write, in addition, Character Studies (from nature and imagination), and Literary Criticisms and Reviews.

In SENIOR year, First Term, students in the Literary Course write, after special investigation, on subjects Political, Æsthetic, and Philosophical. During the Second Term, every member of the class prepares a thesis on some subject especially pertaining to his particular College, or his chosen pursuit. The Literary Course, in addition, includes written Essays on themes Philosophical, Literary, and Oratorical.

Lectures on Composition are given at intervals during the first two years, embracing the subjects of Practical Composition and Rhetoric; such as Punctuation, the Sentence and Paragraph, Qualities of Style, Figures, and Versification.

Throughout the Course eminent examples of each style are studied in connection with criticism of compositions.

HISTORY.

An outline of the instructions which are proposed in History and Mental and Moral Philosophy, cannot be given until the appointment of special Professors in these departments. At present the work of these chairs is distributed among several teachers.

The Sophomore Class are required to make investigations in English History, giving the results in written compositions. (See English Composition.)

The Junior Class in the Literary Course do a similar work in Literary History and Biography; with lectures on special periods.

In the Senior Class a course of lectures on the origin and progress of Modern Civilization has been given by President Gilman, and the members of the College of Letters have received more detailed instruction on the same subject, with constant reference to the writings of Guizot, Bryce, Freeman, Stubbs, Hallam, Lewis, Fisher, etc. This course of lectures will be followed by the study of Civil Liberty, Political Economy, and Social Science, and by a course of lectures on the Functions of the State.

Professor Kellogg gives lectures on Greek and Roman Archæology to the Junior Class, including points of government, law, customs, education, warfare, remains of art, etc.; and to the Senior Class, a course on Greek and Latin Literature; also, a course on the History of Greek Politics.

MENTAL AND MORAL PHILOSOPHY.

In Mental Philosophy, a course of lectures has been given by President Gilman, to the Freshman Class, upon the Culture of the Intellectual Powers.

The Sophomore Class receive instruction in Logic, making use of the Elementary Lessons of Jevons, with reference, also, to his Principles of Science, and to other writings.

The Junior Class has taken up President Porter's Elements of Intellectual Science, the study of which will be continued.

In the Senior Class, instruction will be provided in Moral Philosophy, either by text-book or by lecture.

MODERN LANGUAGES.

The study of two modern languages, French or German, and one other at the option of the student, is required of all the candidates for a Bachelor's degree.

In the College of Letters, French is commenced in the Sophomore year, and German in the Junior year.

In the Colleges of Science, French or German is commenced in the Freshman year, and the other modern language in the Sophomore year, and the study of each language is pursued for three years

The study of Spanish and Italian is optional through the course; and any of the modern languages may be pursued as optional to the end of the Senior year.

Grammar, translations, compositions, the modern history and literature of the principal languages and corresponding nations, constitute the course of instruction in this department. At least one year's instruction in grammar and pronunciation, before entering the University, is desirable, in order to obtain the full benefit of the course of study.

The text-books used vary so as to take advantage of new works bearing upon the subject.

Works for translation are selected with special reference to style, modern history, and literature.

In *German*, the following text books are used, in the order in which they are given here:

"A Practical Course with the German Language," by Woodbury, and Roemer's German Reader; Whitney's Grammar, and Deutsches Lesebuch.

2. Cursus, by Oltrogge; Selections from Goethe, Schiller, Lessing, Uhland, Buerger, Heine, Chamisso, and other prominent German writers.

During the whole course, translations from the English will be required.

Koehler's Dictionary is recommended.

In *French*, the text-books for this academic year are as follows:

Grammars: Otto; Poitevin.

For translation: Histoire du Peuple Français, par Paul Lacombe.

La Littèrature Française Contemporaine, par Mennechet.

Littèrature Française XVIII & XIX sue Siècles, par J. Demogeot.

Corneille—Le Cid; Cinna.

Molière—Le Misanthrope; Les Femmes Savantes.

Racine—Athalie; Esther.

In *Italian*, the text-books are:

Grammars: Robello; Boschi.

For translations: Cantu; Manzoni.

In *Spanish* there are two regular classes—one elementary, commencing in the Autumn of each year. The text-books used are De Tornor's Method; Escosura's Spanish History.

The other, a more advanced class, studying Grammar, Composition, and Conversation, and making use of the following books: Compendio de Gramática Castellana, por P. Hernandez, and Velasquez' Abridged Dictionary of Spanish and English.

LATIN AND GREEK.

For particulars of the course in this department, see the statement under the Classical requirements.

There is a Sub-Latin Class, with a two years' course, for the members of the Literary Course who do not choose to pass the entrance examination of the Classical Course.

There is a short course in Terminology, covering the elementary study of roots and inflections in Latin and Greek, for the benefit of scientific and literary students. It is given in the first half of the Freshman year.

HEBREW.

The instruction in Hebrew is optional, and may be pursued by those students who desire it, at any period during their connection with the University. The instructor will give instruction in Chaldee and Syriac, as well as in Hebrew, if desired.

MILITARY SCIENCE.

The Congressional enactment of eighteen hundred and sixty-two,

from which a portion of the University funds was derived, requires instruction in military tactics.

The laws of California also require that the students be organized into a battalion, for military instruction and discipline.

The course of instruction includes:

I. Tactical instruction in the field, in the Schools of the Soldier, the Company, the Battalion, and Skirmishers.

II. Lectures on the Art of War.

In addition to tactical instruction in the field, instruction is given to the students on the following topics, viz:

1. *Composition and Organization of Armies*—Showing the organization of proportions of different kinds of troops in the armies of the United States, and of the leading Powers of Europe at the present day; with a historical sketch of the Greek Phalanx, Roman Legion, and the style of organization in vogue during feudal times.
2. *The Supply of Armies*—Showing the mode of arming, equipping, clothing, and feeding armies, by the leading nations.
3. *Moving of Armies*—Including transportation by land or water; marches in our own or a friendly country; and marches in the vicinity of the enemy.
4. *Passage of Rivers*—On ice, by fords, by boats, etc.
5. *Military Bridges*—Including an account of bridges improvised from the boats of the country; the construction and use of pontoon bridges; the repair and preservation of bridges; the theory and use of flying bridges; of bridges on casks and inflated skins; the attack and defense of the different kinds of bridges; with historical notices of military bridges in general.
6. *Field Fortification*—Showing the mode of constructing the different kinds of field works, of attacking and defending the same.
7. *Theory of Fire*—Including the phenomena of the combustion of gunpowder; the theory of the flight of projectiles and principles of gunnery; discussion of the shapes and properties of projectiles and the principles of target practice; calculation of initial velocity, etc.
8. The *Principles of Strategy*.
9. *Historical Sketch* of small arms, from the earliest times down to the present day.

The time allotted for instruction in this department is two hours per week, on Tuesdays and Fridays The students are organized into a battalion of four companies. They have been practically instructed in the Schools of the Soldier, the Company, the Battalion, and as Skirmishers, according to the system of Infantry Tactics at present in use in the United States Army.

The military feature of the University is important and beneficial in many respects. In the event of war, it has been invariably found that previous military instruction and training has been of great service to the State, and especially advantageous to those who have received it. As conducted in this University, it does not interfere with instruction in the literary and scientific departments. The drill affords a healthful exercise, and contributes to physical development, and gives additional grace of carriage and general bearing. The discipline, while it is not so rigid as to be irksome, induces a respectful and courteous bearing. It promotes good order and decorum in the daily routine about the University buildings, and its advantages are especially seen on all occasions

when the students are required to move in a body; and it contributes largely towards the cultivation of a proper *esprit de corps*. It may afford the means for maintaining such order and discipline as may be necessary for the general protection of the public buildings and grounds.

Some objection has been made to the military organization, on the ground of the expense attending the purchase of uniforms. The objection is without force. Even if true, that it necessarily involves some slight additional expense of dress, it is an expense which may well be borne, seeing that it is the only additional expense, save board and text-books, incident to University life, since the tuition is gratuitous. But it is believed that so far from being more expensive, a suitable uniform may be provided at less than the average cost of other clothing.

During the past year the arms have been cleaned and repaired, and are now in good condition.

THE SCIENTIFIC DEPARTMENTS.

General statements respecting the Scientific Colleges.

OBJECTS.

The various scientific colleges of the University are designed to give the student a good introduction to the principles of modern science, together with special instruction in that particular department which he may choose. The law of the State requires the maintenance of five distinct colleges, or courses. These are Agriculture, Mechanics, Mining, Engineering, and Chemistry.

THE FIRST TWO YEARS.

The first two years of instruction, in all these colleges, include very nearly the same studies. A solid foundation is laid for all higher pursuits by the careful study of mathematics and the elements of chemistry, natural philosophy, physical geography, etc., as well as of English, French, and German. At the beginning of the third year, the special subjects begin to predominate.

THE TWO ADVANCED YEARS.

In the two advanced years, the third and fourth of the full course, special attention is given to studies immediately relating to any one of the five colleges which the student may have elected—Agriculture, Mechanics, Mining, Engineering, or Chemistry. General studies receive a subordinate degree of attention.

SPECIAL COURSE STUDENTS.

Students who cannot spend four years at the University, but who are qualified to pursue the special studies here arranged for, are received as "Special Course Students," for a longer or shorter time. This is easier in the Colleges of Agriculture and Chemistry than in the other colleges, which presuppose a considerable proficiency in mathematics.

TERMS OF ADMISSION.

Candidates must pass a satisfactory examination in Higher Arithmetic, in all its branches, including the extraction of square and cube roots, and the metric system of weights and measures; Algebra, to Quadratic Equations; Geometry, first four books (Davies' Legendre, or Loomis); English Grammar, Geography, and History of the United States.

It is believed that these requirements can be met by a bright and determined scholar residing in any part of the State. The proper text-books are easily procured. The examination is meant to be thorough and strict, but it is not meant to be so technical or exacting as to deter scholars who have not had the best advantages of tuition. Students who show a capacity to pursue with profit the course marked out, are sometimes admitted on condition that they will make up their deficiencies.

Although no requirements in Natural Science are specified, the study of Local Botany, Mineralogy, and Natural History is recommended, both because of the knowledge which may be acquired, and because of the habits of accurate observation of nature which may thus be formed in early youth.

Students are advised to devote at least one year to the study of Latin, before entering this department. It will greatly help their acquisition of Modern Languages, and will be useful in their study of science. Allen & Greenough's Grammar and Allen's Latin Reader are especially commended as good manuals for this purpose.

Proficiency in some one or more of the Modern Languages is also very desirable.

COLLEGE OF AGRICULTURE.

SPECIAL STATEMENTS.

Terms of Admission.—The terms of admission are the same as to the other Scientific Colleges, and are described on a previous page.

Special Students in Agriculture, not desiring the full course, are received for a longer or shorter period, and may attend only special lectures and recitations and practical exercises, according to their requirements.

Methods of Instruction.—The instruction is given by experimental and illustrated lectures, recitations, essays, and class discussions, and in the practical application of principles, upon the University grounds. In addition, orchards, vineyards, farms, dairies, and all places of agricultural interest and importance are visited by the class, as far as practicable, under the guidance and instruction of the Agricultural Professor.

The University domain is being developed, with a view to illustrate the capability of the State for special cultures, whether of forest, fruits, or field crops, and the most economical methods of production. It will be the station where new plants and processes will be tested, and the result made known to the public.

Text-books and Works of Reference.—Johnson's How Crops Grow, How Crops Feed; Downing's works on Horticulture and Landscape Gardening, Caldwell's Agricultural Chemistry, Darlington's Useful Plants, Gamgee & Law's Anatomy of the Domestic Animals, Gamgee's Domestic Animals in Health and Disease, Goodale's Breeding, Randal's Sheep

Husbandry, Harris on Insects, Reports of the Agricultural Bureau at Washington, Transactions of the California State Agricultural Society, Horticultural and Agricultural Journals of California.

Most of the recent American books on Scientific Agriculture have been placed in the Agricultural Library.

SCHEDULE OF STUDIES.

FOURTH OR FRESHMAN CLASS.

First Term.—Mathematics—Algebra; French or German—(Begun); English—History and Structure of the Language; English Composition; Terminology; History, Drawing—Freehand; Physiology—Lectures.

Second Term.—Mathematics—Geometry; Chemistry—(Recitations and laboratory practice); French or German; English Composition; Rhetoric; Vocal Culture; History; Drawing—Freehand; Physical Geography—Lectures.

THIRD, OR SOPHOMORE CLASS.

First Term.—Mathematics—Trigonometry, plane and spherical; Analytical Geometry; Chemistry; Physics—Heat; Botany; French or German; English Language—History and Structure; English Composition; Drawing—Free-hand and Industrial.

Second Term.—Mathematics—Analytical Geometry completed, Surveying and Irrigation; Chemistry; Physics; Mechanics; Zoölogy; French or German; English Language and Literature; English Composition; Drawing—Free-hand and Industrial.

SECOND, OR JUNIOR CLASS.

First Term.—Agriculture; Agricultural Physics; Inorganic Chemistry—Lectures; Analytical Chemistry; Mechanics; Zoölogy; German or French; History of English Literature; English Composition; Mental Philosophy; Spanish or Italian—(Optional through the year); Drawing—(Optional through the year).

Second Term.—Agriculture; Agricultural Chemistry; Inorganic Chemistry—Lectures; Analytical Chemistry; Mechanics; Physics; Zoölogy; Geology; German or French; History of English Literature; English Composition.

FIRST, OR SENIOR CLASS.

First Term.—Agricultural Botany; Agricultural Mineralogy; Organic Chemistry—Lectures; Analytical Chemistry; Physics; Geology; Astronomy; German or French; Linguistics—Study of Language; English Composition; Modern History—Lectures; Moral Philosophy—Lectures. Spanish or Italian—(Optional through the year).

Second Term—Agricultural Geology; Tillage and Special Cultures; Rural Economies, etc.; Organic Chemistry—Lectures; Analytic Chemistry; Physics; Geology; Mineralogy; German or French; Linguistics; English Composition; Logic; Political Economy—Lectures; Law—Lectures; Thesis—(Preparatory to graduation).

During the past year the following lectures have been delivered before the students in this department:

Synopsis of a Course of Lectures on the Origin, Composition, and Functions of Soils, and their bearing on Agriculture, delivered at the University of California, during the First Term, eighteen hundred and seventy-four–seventy-five, by Professor EUG. W. HILGARD.

Definition of "Soil"—

- Different meaning as referred to different plants.
- Judging of Soils by the natural growth.
- Different forms of trees, etc., on different soils, and errors resulting from their neglect.

Exceeding complication of considerations in judging of the value and nature of soils, involving a very varied knowledge and careful judgment, or long and costly experimenting.

Hence necessity for scientific examination on the spot, and mechanical and chemical analysis of soils—to serve as guides for practice, or practical tests.

Necessity for coöperation between farmers and scientists, to prevent endless mistakes and expense.

Experimental Stations.

ORIGIN OF SOILS.

Mechanical and chemical disintegration of rocks—

- Mineral composition of important crystalline rocks.
- Chief rock-forming minerals.
- Quartz, the Feldspars, Mica, Hornblende, Augite, Talc (Serpentine.)
- Calcareous Spar or Calcite, Dolomite, Gypsum, Apatite.
- Decomposition of these by atmospheric agencies; Water, Carbonic Acid, Oxygen, Ammonia.
- *Quartz*—Soluble and insoluble forms.
- *Feldspars*—Formation of clays and carbonates.
- *Hornblende* and *Augite*—Formation of ferruginous clays, loams, carbonates.
- *Mica*—Difficult to decompose.

Sedimentary rocks—Sandstones, shales, limestones, how formed; their composition.

- Character of soils derived from these several rocks.
- *Feldspar* the source of potash.
- *Apatite* that of phosphates.

Decomposition greatly accelerated by pulverization.

- Effects of frost on rocks.
- Mechanical Attrition.

Mechanical processes active in soil formation.

- Action of flowing water.
- Action of water charged with sand and gravel.
- Action of Glacier ice.

COMPOSITION OF SOILS.

General Soil Ingredients are—

- Unaltered Rock-powder.
- Altered Rock-powder.
- Clay.
- Vegetable matter.

According to the proportion of these they may be classed as—

LIGHT SOILS.		HEAVY SOILS.	
Sandy,	Humous.	Clayey,	Siliceous.

Definition of these terms.
Great diversity of sub-classification, adapted to local circumstances, and locally very important.

DETERMINATION OF CHARACTER OF SOILS.

Observation in the Field—Derivation, Position, Depth, Substratum, Natural growth, Climate.
Experience in cultivation.
Taking of fair specimens—difficulty—precautions.
Examination of subsoils best adapted to general purposes.
PHYSICAL PROPERTIES of soils—quite as important as chemical composition.
"Lightness"—"Heaviness"—Porosity—Absorption of aqueous Vapor—Water-holding power—Capillary coefficient—Color—Specific gravity.
Difficulty and tediousness of direct determination of these.
Mechanical analysis as a substitute, sufficient for practical purposes.
Elutriation. Subsidence method—faults.
Hydraulic method.
Apparatus of Noebel—Fresenius—Mueller—Schoene.
Mixed character of sediments, and inconstancy of results. Causes—"Flocculation."
Preliminary preparation—Boiling—removal of gravel and clay prior to washing.
The *Churn Elutriator* or *Soil-washer*—Construction—Precautions in use.
Character and nomenclature of sediments.
Direct determination of Clay by precipitation.
Action of common Salt. Lime.
Influence in formation of bars at river mouths.
Importance of Flocculation—Effects of tillage—"Woolly" condition—Tamping of clays.
Molecular properties of sediments—absorptive coefficients—mechanical resistance.
Estimation of tillability of soils; influence of sediments on "lightness" and "heaviness;" clay not the only factor of "heaviness."
Influence of Flocculation.
Porosity *vs.* Resistance to tillage.
Absorbing power of Soils.
Not in direct ratio to clay. Examples.
Influence of Sediments—of Ferric Oxide—of Humus.
"*Humus.*"—Its origin and influence on the physical properties of Soils.
Summary of functions of physical soil ingredients.
CHEMICAL COMPOSITION, AND ANALYSIS OF SOILS—
Elements concerned in formation of Soils.
Whence derived.
Nutritive and inert Soil ingredients.

Ash ingredients of Plants; derived from Soil; Carbon from Air; Nitrogen from both.
Apriori view of Soil analysis—Composition of crops.
Fallacies.—Distinction between available and unavailable portion of nutritive soil ingredients.
Difficulties, and attempts to overcome them.
Causes of failure—rejection of soil analysis.
Professor Johnson's arguments.
Discussion of objections.—What soil analysis may fairly claim to do for practice, in application to virgin soils.
To identify and distinguish soils, thus making past experience available in new regions.
To determine their prominent characteristics, both physical and chemical.
To show abundance, scarcity, or absence of important soil ingredients, thus indicating the general adaptation, permanent value, and cheapest mode of improvement, or maintenance of fertility.
Always provided, that systematic observation on the spot, of all circumstances influencing cultivation, and comparative examination of soils of similar origin, be kept in view. Mere columns of figures of little use.
Taking of Specimens—details.
Methods of chemical analysis; elements to be determined.
Choice of solvents. General Analysis—Details.
Determination of Phosphoric Acid.
Determination of "Humus" and Nitrogen.

FUNCTIONS OF THE SEVERAL CHEMICAL SOIL INGREDIENTS, AND THEIR CONDITION IN THE SOIL.

Outlines of Vegetable Physiology—
Experiments on growth of plants in soils devoid of organic matter; in solutions.
Object of the course mainly the consideration of the indispensable soil ingredients, their distribution, functions, and sources of supply.
Distribution of Ash ingredients in Horse Chestnut, Beet, Cereals, etc.
Amount and character of ashes in old and young leaves, stems, wood, etc.

Metallic Elements.

Potash.—Percentage contained in soils. Examples. How contained. Feldspar—Zeolitic compounds. Mechanical absorption. Liebig's experiments.
Laws of surface absorption. Composition of drain waters.
Root crops especially exhaustive of Potash.
Potash manures in general.
Soda.—Inferior in importance to Potash.
Small amount in soils—easily washed out, yet rarely needs to be supplied.
Salty soils—Salt plants.
Sodium salts used in agriculture.
Other Alkalies in minimum quantities.
Lime.—Amount usually present in soils. Relation to Potash. Nutritive as well as stimulant.

Largely present in *stems.*
General importance as a soil ingredient, both physical and chemical.
Effects on mechanical condition of Soil—
"Flocculation."
Renders soils loose, pervious, tillable—"warms" them.
Chemical Effects of Lime—"fallowing" action.
Effects on organic decay, and formation of "humus."
How present—carbonate, sulphate, phosphate, humate.
Natural characteristics of calcareous soils—their growth, color, thriftiness. Examples.
Importance of a supply of lime to Agriculture.
Magnesia.—Like lime, important *stem* ingredient.
Rarely deficient in soils—seldom needs to be supplied. Partially replaces lime.
Percentage in Soils. Numerical relation to potash. How present in soils.
Copiously carried off in drain waters. Soluble magnesium salts injurious to vegetation.
Alumina.—Not a true ash ingredient, though often found in ashes.
Origin of clays. Varieties. Kaolin. Pipe Clay. "Soapstone." Brick Loam.
Tints imparted to clays by Iron—changes by oxidation and reduction.
By Manganese—by Carbon—how recognized.
Recapitulation of the properties of clay as a soil ingredient.
Iron.—Widely diffused, omnipresent. Nutritive as well as mechanically important. Tonic.
Hygroscopic efficacy of ferric oxide; chemical inertness.
Proto salts poisonous. Reduction of ferric oxide by vegetable matters. Yellow mud and blue mud.
Bottom lands—blue subsoils—"rusting" soils.
Iron in surface soils and subsoils.
White or "Crawfishy" soils—Black pebble or bog ore subsoils. Deterioration of soil thereby: causes.
Chalybeate Springs. Formation of Ferruginous sandstone.
Manganese.—Vicarious of Iron. Less important.
Copper.—In very minute quantities, in wheat, potashes, etc.

Non-metallics.

Silicon.—Silica predominant ingredient of soils.
Sand and silicates.
Apparently unessential to plants but very largely absorbed by grasses, pines, etc. "Lodging" of grain.
Silica in drain waters—Acid soils—Action of lime.
Sulphur.—Sulphates omnipresent. Small percentage in soils. Often deficient.
Cheaply supplied by gypsum. Sulphates in drain water.
Effects of fermentation on sulphates. Iron pyrites, etc. Remedies.
Phosphorus.—Phosphates of highest importance to nutrition of plants and animals.
Derivation of soil phosphates. Small percentage—relation to Potash.

Accumulation in seeds. Small-seeded plants on soils poor in phosphates.
Their deficiency a common cause of sterility.
Must be currently restored to cultivated soils.
Effect of bonedust on old pastures.
Chlorine.—Present in all soils and plant ashes.
Correlative with Sodium. Rarely deficient.
Fluorine.—Very generally present in small quantities.
Most largely in bones.
Iodine.—Common, in traces.
Carbon.—Ultimately derived from air: directly in part from soil. Formation of humus by decay of vegetable matter.
(Physical effects of humus on soils—see above.)
Chemical effects on soil ingredients.
Action of Crenic and Apocrenic acids.
Oxidation of humus. Production of carbonic acid, the universal solvent.
Direct absorption of soluble vegetable matter.
Hydrogen.—Absorbed by plants in shape of water.
Nitrogen.—Highly important nutritive and constituent ingredient. Flesh former.
Free nitrogen of air not assimilable.
Ammonia and nitric acid of atmosphere—absorbed by soil. Inadequate for crops.
Nitrogen in soil. How contained. Small percentage and largely unavailable.
Connection with humus—Nitrification accompanying oxidations, evaporation, etc.
Ozonization. Formation of Hydrogen Peroxide.
Possible agency of microscopic plants in soil.
Necessity for artificial supply of Nitrogen for crops. Nitrogen Theory *versus* "Mineral" Theory.
General effects of nitrogenous manures on plants.

EXHAUSTION OF SOILS.

Recapitulation:
"All plant ingredients must be simultaneously present in sufficient quantities. Absence of *one* renders *all* inert."
"Supplying that *one* deficient ingredient enormously profitable."
"Excess of *any* lies inert in the soil as dead capital."
Hence the necessity for

Rotation of Crops.

Causes of necessity for rotation. Abstraction of different ingredients in unequal degrees by different crops.
Different depth of roots—fibrous and taproots.
Examples.
Rotation utilizes soil resources best. Makes interest accrue on the *whole* soil capital. Should be the guiding principle in all cases.
Order of rotation can be determined by analysis of crops.

MODIFICATION OF SOILS BY ARTIFICIAL MEANS.

1. *By Mechanical operations.*
   Tillage secures looseness, easy penetration of roots, circulation of air, soil gases, and water.
   How nature tills—mulching, frost, wetting, and drying.
   Artificial condition of culture; overriding of natural adaptations of soils and localities. Hence necessity for tillage, preparation, and cultivation.
   Importance of depth of soil for equalization of extremes and safety of crops.
   Depth of soil equivalent to cultivating larger areas, but with less labor and greater safety to crops.
   In shallow soils, crops are at the mercy of seasons.
   Heavy soils need thorough tillage most.

Deep tillage—subsoiling.

Chemical and physical differences between soil and subsoil.
Stirring versus turning up—conditions under which either may be useful or injurious.
Treatment of subsoiled lands, for maintenance of profitable productiveness.
Subsoiling not a preventive of exhaustion.

Drainage—underdraining.

"Relieves wet soils;" but does a great deal more—useful in all soils.
General plan of underdrains. Various methods: tile drains, log drains, brush drains, etc.
Mode of action, difficulties, and remedies.
Action of underdrains on clay soils. Analogy to subsoiling; protection against drought by deepening of soil.
Drained lands can be tilled at all times; are less cold; less liable to surface washing.
Advantages to public health.

2. *By addition of Material*—(*a.*) "*Mechanical Manures.*"
   Not often profitable by themselves; should be combined with other objects.
   Management of natural drainage to effect desirable changes.

(*b.*) *Chemical or true manures.*

Exhaustion of soils an historical fact, repeating itself.
Comparison of amount of nutritive ingredients in soils with ash ingredients of crops.
Why soils cease to be productive, notwithstanding "stimulant" and nutritive manures.

Green manuring, rationale and practical. Deep-rooted plants versus shallow ones.
Grasses, peas, clover, etc.
Ville's ideas respecting clover.

Mulching.—Effects and rationale of. Forest leaves, straw, long manure, grass, etc. Shading, surface manuring.
Swamp muck.—Composition. Mechanical and chemical action.
   Clay a substitute for humus.
   Dana's Muck Manual.
Quicklime.—Direct chemical action on soil constituents.
   Carbonate acts similarly, but more gently.
   Exhaustive effects of excessive use; sudden "giving out" of calcareous soils.
   Favorable action of lime on physical and chemical condition of soils generally; importance of cheap supply.
Marls and Marling.—Definition.
   Difference between marls and quicklime.
   Examples—Marls of the Southern States.
   Different condition of ingredients in soil and marls.
   Comparative analyses.
 Limited duration of the effects of marling. Causes.
   Overdressing with marls. Pyrites. Precautions and remedies.
   Effects of marling on health.
Gypsum.—Land plaster.
   General effects; transformation into carbonate.
   Special effect on clover, etc. Unfavorable action on acid soils.
Phosphate Manures.
   Apatite, Phosphorite—Occurrence.
   Charleston, Venezuela, Spain, Russia. Coprolites.
   Inertness as manures.
 Bones; Effects of roots on same. Roger Williams.
 Bone meal, raw and steamed. Importance of fineness. Composition.
   Solubility of bone phosphate in carbonic acid.
   Superphosphate of lime. Manufacture.
   Solubility, agricultural value and reversion.
   Uncertain value of the commercial article.
   State inspection.
Guano.—Origin. History.
   Composition. Value.
   Defects, as an incomplete manure. Causes of final inefficacy.
   Manure most profitable when complete.
Imitations of guano.—Ammoniated phosphates.
   General character. Manufacture.
   Value of flesh and membranes *versus* horn and leather.
   Uncertainty of composition. Difficulties in determining value. Liability to spoiling.
Ammonia salts as furnishers of nitrogen.
   Manufacture of commercial sulphate. Value. Effects of excess of ammonia on vegetation. Remedies.
Nitrates as sources of nitrogen.
   Potash nitrate desirable but expensive.
   Sodium nitrate—Chilian saltpetre. Commercial and nutritive value. Loss by drain waters.
Common salt.
   Salt plants. Effects of excess of salt on ordinary vegetation.
   Effects as a manure—often over-estimated.
Potash manures—Sources of Potash.
   Potash less important than phosphates on fresh soils.
   What soils are rich in potash.

Feldspar—not available.
Glaukonite.—Greensands of New Jersey—Virginia—Mississippi.
Greensand marls of Gulf States.
Stassfurt potash salts—"Kainite," etc.
Their origin—artificial preparation from sea water.
Potash salts of the alkali plains, Nevada.

Ashes.
Composition of unleached and leached, and comparative value.
Soft *versus* hard soap. Agricultural value of ashes compared to that of unburned materials.

Stable manure.
Complete manure. Analysis.
Excrements, derivation and nature of; solid and liquid.
Decaying organic matter *plus* ammonia *plus* mineral matter highly available and soluble.
Preservation of stable manure.
Preventing waste of soluble and volatile matters—composting.
Absorbents — Litter — Sawdust — Muck — Earth — Marls — Lime — Gypsum — Ashes — Bonemeal — Superphosphate.
Comparative value of old and recent manure; many circumstances control it. Climate. Distance. Cost of transportation—origin—nature of crop—soil, etc.
Difference of value of manure from different feeds—each best adapted to its own kind.
Direct *versus* indirect application. Cotton seed, etc., oil cakes—effects.

Value of human excrements. Causes of preëminent efficacy.
Prejudices against their use.
Japanese and Chinese practice. American experiments.
Results.
Privies. Cesspools, city sewage.
Attempts to utilize sewage but partially successful on a large scale. Causes.

The earth closet.
Disinfecting power of dry earth. Hebrew and Feline practice.
Moule's earth closet. Value of earth closet manure. Cost of transportation.
Necessity of radical change in our habits involving waste of night soil.
Supply of dry earth in cities.

METHOD OF CULTURE.

Three fundamental faults in our system.

1. "Robbing the soil." Failure to return soil ingredients withdrawn by crops.
   No permanent productiveness without return to the soil.
   The fabulous soil that never gives out—somewhere out West.
   Experience in the old world. Italy. Spain. Germany. England.
   Egypt and Holland exceptions—Why.
   Experience in the United States. Steady decrease of productiveness from the Atlantic to the Mississippi, advancing westward.
   Result of cotton culture with and without return. Condition of Virginia and of the Gulf States.

   Mystic formulæ and patent manures *versus* brains and educated judgment.
   "Manuring too troublesome and will never pay." Very sad for mankind if true.
   Moral aspects of exhaustive culture—"after us the deluge."
   Exhaustive culture equivalent to using up one's capital. Interest-bearing power of soil. Compounding of interest when return is made.
2. *Imperfect culture.*
   Scratching a large surface *versus* "intense culture."
   Cultivating much land badly.
   Cost of majority of agricultural operations proportional to surface.
   Insecurity and inferior quality of crops the result of shallow tillage.
   Washing away of surface soil.
3. *Failure to rotate.*
   A grievous mistake under any ordinary circumstances.
   Experience in the Gulf States—in the West.
   Rotation not intrinsically desirable. May be avoided by making exact returns. Cotton.
   General summary.

In addition to the foregoing, Professor Hilgard delivered several lectures "On the Chemistry of Household Life."

Synopsis of two Courses of Lectures by Professor C. E. Bessey, *of the State Agricultural College of Iowa, given at the University of California, in January and February, eighteen hundred and seventy-five.*

FIRST COURSE.

ON ECONOMIC BOTANY: OR ON THE PLANTS USEFUL AND HARMFUL TO MAN.

I. THE FUNGAL ALLIANCE.

1. Growth and Reproduction of Fungi.
2. Outline of their Classification.
3. The Blights of the Rose, Hop, Pea, and Grape.
4. Ergot, and the Black Rust of the Plum.
5. The Molds of Fruit and Pastry.
6. The Potato Rot Fungus.
7. Cluster Cups, Rust, Smut, and Bunt.
8. Dry rot as produced by Fungi.
9. Edible species.
10. Resumé of remedies.

II. THE GRASS FAMILY.—(*Gramineæ.*)

1. Size, distribution, and botanical characteristics of the group.
2. The Cereals, or grasses grown for their seeds:
   (*a*) General discussion of Rice, Wheat, Barley, Rye, Oats, and Indian Corn.

(*b*) Varieties, and methods of culture.
(*c*) Commercial importance; annual exportation.

3. The Forage Plants, or the Grasses grown for their stems and leaves.

(*d*) Requisites in a good Forage plant.
(*e*) General discussion of Meadow Foxtail, Timothy, Red Top, Orchard Grass, and Kentucky Blue Grass.
(*f*) Nutritive values as shown by chemical analyses.
(*g*) Experiments suggested upon promising wild species.

4. The Canes, or Grasses grown for their sweet juice.

(*h*) The Sugar Cane of the South.
(*i*) Chinese Sugar Cane.

5. The Weeds of the group.
6. The Ornamental Grasses.

III. THE LILY FAMILY.—(*Liliaceæ.*)

1. Food plants; Asparagus, Onion, Leek, Garlic.
2. Medicines; Aloes, Squills, Solomon's Seal, White Hellebore.
3. Ornamental plants; Tulip, Lily, Tuberose, Hyacinth, Tritoma, Dragon Tree.

THE PINE APPLE.—(*Bromeliaceæ.*)

4. The Pine Apple. Nativity, culture, use.

THE BANANA FAMILY.—(*Musaceæ.*)

5. The Banana and Plantain as food plants.

THE ORCHID FAMILY.—(*Orchidaceæ.*)

6. Peculiarities of the plants of the family.
7. The Vanilla plant of tropical America.
8. The high ornamental value of the Orchids.

THE PALM FAMILY.—(*Palmaceæ.*)

9. Great value of the Palms to inhabitants of the tropics.
10. Food plants—Cocoa Nut, Sago Palm, Cabbage Palm, etc.
11. The Rattan and Ivory Palms.

IV. THE PINE FAMILY.—(*Coniferæ.*)

1. Size and geographical distribution of the group.
2. The important timber trees in the genus *Pinus*, the Pines.
3. The Firs, Cedars, and Redwoods used for timber.
4. Tar, Pitch, Turpentine, and Balsams.
5. Ornamental value of the Conifers.

THE OAK FAMILY.—(*Cupuliferæ.*)

6. British Oak; Live Oak and White Oak.
7. The California Oaks.
8. The Beech, Chestnut, and Filbert.

THE WALNUT FAMILY.—(*Juglandaceæ.*)

9. Value of timber of Walnut and Hickory.
10. The edible nuts of the order.

V. THE NETTLE FAMILY.—(*Urticaceæ.*)

1. The English and American Elms.
2. Bread fruit, and Milk trees of the tropics.
3. The Fig and Mulberry.
4. The India Rubber Tree of India.
5. The Osage Orange as a hedge plant.
6. Ramie, Hemp, and the Hop.

THE SPURGE FAMILY.—(*Euphorbiaceæ.*)

7. The India Rubber Tree of South America.
8. The Box tree.
9. The Medicinal plants of the group.

THE LAUREL FAMILY.—(*Lauraceæ.*)

10. The Laurel tree of Europe, and the California Laurel.
11. Cinnamon, Camphor, and Sassafras.

VI. THE OLIVE FAMILY.—(*Oleaceæ.*)

1. The Ash as a timber tree.
2. Olives and Manna.

THE NIGHTSHADE FAMILY.—(*Solanaceæ.*)

3. The Potato, Egg Plant, Tomato, Ground Cherry, and Cayenne Pepper.
4. Stramonium, Belladonna, and Henbane.
5. The Tobacco plant.
6. Poisonous character of the plants of the order.

THE MINT FAMILY.—(*Labiateæ.*)

7. Medicinal plants of the order.
8. The ornamental plants.
9. Absence of woody and textile products.

VII. THE EBONY FAMILY.—(*Ebenaceæ.*)

1. The Ebony Trees of Mauritius and the East Indies.
2. The Kaki, Persimmon, and Date Plums.

THE STAR-APPLE FAMILY.—(*Sapotaceæ.*)

3. The Gutta Percha Tree of the East Indian Archipelago.
4. Star-Apples, and Sapodilla Plums of the West Indies.

THE HOLLY FAMILY.—(*Aquifoliaceæ.*)

5. The Holly Tree of Europe and Eastern United States.
6. The Paraguay Tea Tree.

VIII. THE HEATH FAMILY.—(*Ericaceæ.*)

1. The Heaths of Europe and South Africa.
2. The Madrona and Manzanita of the Pacific Coast.
3. Blueberries, Huckleberries, and Cranberries.
4. Ericas, Azaleas, Rhododendrons, and other ornamental plants.

THE SUNFLOWER FAMILY.—(*Compositæ.*)

5. Great size, and wide distribution of the order.
6. Artichokes, Salsify, Lettuce, Endive, and other food plants.
7. Dandelion, Wormwood, Arnica, and others of medicinal value.
8. The Sage Brush (*Artemisia*) of the plains.
9. The ornamental plants, Asters, Daisies, Dahlias, etc.
10. The Weeds—Thistles, Cocklebnrs, Ragweeds, Whiteweeds, etc.

IX. THE MADDER FAMILY.—(*Rubiaceæ.*)

1. Coffee Tree.
2. The Cinchona or Peruvian Bark (Quinine) Tree.
3. Madder and Ipecacuanha.

THE PARSELY FAMILY.—(*Umbelliferæ.*)

4. Peculiar principles of the plants of this order.
5. The food plants—Parsnip, Carrot, Celery, etc.
6. Aromatic products of the order.
7. Asafœtida, and Ammoniacum, the gum resinous products.
8. Poisonous plants of the order.

X. THE MYRTLE FAMILY.—(*Myrtaceæ.*)

1. The Eucalypti, Turpentine Trees, and Myrtles as timber trees.
2. Guavas, Malay Apples, and Rose Apples of the tropics.
3. Cloves and Allspice.
4. Medicinal and ornamental value of the order.

THE ROSE FAMILY.—(*Rosaceæ.*)

5. Almonds, Peaches, Plums, and Cherries.
6. Strawberries, Raspberries, and Blackberries.
7. Pears, Apples, and Quinces.
8. The timber trees of the order.
9. The medicinal and ornamental products.

THE PULSE FAMILY.—(*Leguminosæ.*)

10. The Food and Forage plants—Beans, Peas, Clover, etc.
11. The Timber Trees—Rosewood, Locust, Acacia, Jamaica Ebony, etc.

12. The Gums and Medicinal products (Gum Arabic, Liquorice, etc).
13. Indigo, Logwood, Brazilwood, and others dyes.

XI. VARIOUS FAMILIES.—(*Aceraceæ* to *Magnoliaceæ.*)

1. The Sugar Maple, Red Maple, and Oregon Maple.
2. European and American Grape Vines.
3. Mahogany, Australian Cedar, and Zebra Wood.
4. The flax plant and its products.
5. The Tea Tree of China and Japan.
6. Cotton and the Cotton Plant.
7. The Cabbage, Turnip, Radish, and their allies.
8. The Opium Plant, and its products.
9. The Whitewood or Yellow Poplar.
10. The Magnolias, for timber and ornament.
11. THE BEST BOOKS ON ECONOMIC BOTANY.

SECOND COURSE.

ON THE PRINCIPLES CONTROLLING THE VARIATION OF PLANTS AND ANIMALS.

I.

1. The fact of variability in plants and animals.
2. Examples illustrating variability.
   The Cabbage sub-species and varieties.
   The varieties of the Apple.
   Easy variability of Tomato and Potato.
3. How man has made use of varieties.
4. Man can produce varieties in plants and animals.
5. The causes of variation which man can control.

OF REPRODUCTION IN GENERAL.

6. Essential features of sexual and non-sexual reproduction.
7. Wide separation of sexual and non-sexual processes in the lowest plants.
8. Gradual approach of these processes in the cryptogamic series.
9. Reproduction in the higher plants.
10. Sexual and non-sexual reproduction in animals.

II.

1. The stability of animal and vegetable forms.
2. The Prepotency of the male or female.
3. Prepotency of certain breeds.
4. Prepotency conducive to stability.
5. Intimate intercrossing as affecting stability.
6. Reversion to ancestral forms, in plants and animals.
   (*a*) In a pure breed to a lost character.
   (*b*) In a breed nearly pure, to a character belonging to the impurity.
   (*c*) May be developed by age.

(*d*) May be developed by crossing.
(*e*) Reversion of hybrids.

7. The age of a character, as affecting its stability.

III.

1. Crosses and Hybrids essentially the same.
2. The limits of crossing.
3. Causes which prevent crossing.
4. The sterility of hybrids.
5. The production of new breeds by crossing.
6. Sterility, Prepotency, and Reversion as difficulties.
7. Crossing by Grafting or Budding.
   (*a*) Effect of stock on scion.
   (*b*) Effect of scion on stock.
8. Bud variations in plants.
9. Spots in animals.

IV.

1. Climate as a cause of variation of forms.
2. The indigenous plants and animals as modified by the climate.
3. Characteristics of the flora and fauna of particular districts.
4. Effect of more or less humidity upon the vegetation of a country.
5. Alpine varieties of plants.
6. Culture equivalent to a change of climate.
7. Effect of high and low culture.
8. The production of varieties by culture.
9. The necessity of *selection* in culture.
10. The duration of cultivated varieties.
11. The use and improvement of the native species of any country.

Synopsis of a Course of Lectures on the Principles of Stock Breeding, by Prof. WM. H. BREWER, *of the Sheffield Scientific School, Yale College, given at the University of California, March and April, eighteen hundred and seventy-five.*

[The numbers refer to the topics in the order of their treatment, and not to the number of the lectures when given. The lectures were illustrated by diagrams, plates, and tables.]

I.—INTRODUCTION.

1. Dependence of agriculture on domestic animals.
2. The part they play in our agriculture.
3. Breeding and rearing domestic animals the most ancient and most universal of all industries.
4. Breeding, as an art, very ancient.
5. As a science, quite modern.
6. What constitutes domestic animals.
7. Wherein they differ from merely tamed ones.
8. The nature of instincts.
9. What changes domestication necessarily involves.
10. Most animals can be tamed; few have been domesticated.

11. Classification of domestic animals:
    a. Those bred for food only.
    b. Those bred for their products.
    c. Beasts of burden.
    d. Those bred for fancy, or as pets.
    e. Those bred for various other purposes.
12. The principles involved in breeding all these are essentially the same.
13. This course of lectures relates to the scientific principles of breeding.
14. Qualifications necessary for high success in practice.
15. Technical terms defined.

II.—HEREDITY.

1. Heredity of specific characters.
2. Of race characters.
3. Of individual peculiarities.
4. Of recently or artificially acquired characters.
5. Of diseases.
6. Mutilations not hereditary unless disease results.
7. Permanence of certain characters.
8. Varying force of heredity.
9. Causes which modify or influence its force.

III.—VARIATION.

1. Variation resulting from known causes or conditions.
   a. These usually slight in character, but often important.
   b. Variations resulting from the relative nature or abundance of food.
   c. From climate.
   d. From natural enemies.
   e. From man's protection and care.
   f. From training and uses.
2. Variation is called "*spontaneous*"—that is, which results from causes or conditions as yet unknown.
   a. These either slight or great.
   b. Characters belonging only to the individual.
   c. The sudden appearance of new characters.
   d. Wide variation known as "*sporting.*"
   e. Illustrations of these.

IV.—MUTUAL RELATIONS OF HEREDITY TO VARIATION.

1. The characters acquired through variation usually transmitted in part.
2. All of them in one individual are never transmitted, hence continued variety.
3. Sports often transmit their essential peculiarities entire or not at all.
4. New breeds of animals, sometimes (though rarely) originate from sports.
5. New varieties of cultivated plants very often so originate.

V.—Breeding to Points.

1. The geometrical ratio of increase gives great range for selection of breeding animals.
2. The formation and improvement of breeds by the selection of parents having desirable points.
3. This is the origin of most breeds.
4. This is the universal method of improvement of breeds.
5. High excellence is the accumulated sum of slight individual excellences, added up from generation to generation.
6. Scales of points.
7. Illustrations from the hog.
   a. Change from the wild boar to the domestic hog.
   b. The production of various breeds after once domesticated.
   c. What changes in structure have followed.
   d. Changes in habits and instincts.
8. Illustrations from the racehorse.
   a. The horse of antiquity.
   b. The horses of modern Turkey, Arabia, and Barbary.
   c. Origin of the English thoroughbred.
   d. Stakes or prizes won in races the essential incentive to improvement.
   e. Magnitude of the prizes won by successful horses.
   f. Character of the competition.
   g. Nature of the problems involved.
   h. The results as shown by actual speed attained.
   i. Comparative times in mile heats.
   j. The limit of speed is perhaps very nearly reached.
   k. This illustrated by the number of horses whose record is within three seconds of the best time.
   l. Similar results shown by the records of four-mile heats.
   m. Value of these illustrations, because of the detailed history we have of the process.
9. Illustrations from the American trotters.
   a. Their history.
   b. The principle illustrated by the gradually decreasing time made, from 2:33 in eighteen hundred and thirty, to the present time.
   c. Further illustrated by the present number (perhaps 600) of 2:30 trotters.
   d. Mechanical and physiological problems involved in these improvements.
   e. Relations to heredity and constitution.
   f. Relations to training and care.
10. Illustrations from other breeds of horses.
   a. Draught horses.
   b. Roadsters.
   c. Ponies.
   d. Mountain horses.
   e. Horses of islands.
   f. Indian horses.
   g. Wild and half-wild horses.
11. Illustrations from various breeds of cattle.
   a. For beef.
   b. For milk.

   c. For cream, butter, and cheese.
   d. For special uses and special conditions.
12. Illustrations from sheep.
   a. Wonderful variety of breeds.
   b. For quality and quantity of flesh.
   c. For quality and quantity of wool.
   d. The special conditions of markets.
13. Illustrations from Poultry, etc.
   a. Fowls
   b. Pigeons.
   c. Rabbits.
14. Illustrations from Dogs.
   a. Great number of breeds.
   b. Great variety of characters.
   c. Variety of uses and fancies.
   d. How the size, frame, and structure have been modified by breeding to special points.
   e. How natural instincts have been modified and new ones formed.
15. Illustrations from Canaries and other animals bred as pets or for fancy.
16. Essentially the same principles involved in all these illustrations.
17. The details only to be varied in special practice.
18. The element of time necessary for these changes and improvements.

VI.—Limitations of Breeding to Points.

1. The improvement cannot be continued indefinitely in one direction.
2. Correlations of growth.
3. Illustrations of how certain defects arise and increase along with the improvement.
4. Illustrations where such correlations are from obvious causes or dependence.
   a. With sheep—relations between fibre and flesh; between fibre and hardiness.
   b. With horses—weight and strength; texture of bone and speed.
   c. With poultry.
5. Correlation where cause of the dependence is not obvious.

VII.—Pedigrees.

1. Use and character of Herd and Stud Books.
2. Thoroughbreds, grades, and mongrels.
3. Relation of pedigree to subjects II and V.

VIII.—Atavism or Revision.

1. Facts stated and illustrations given.

IX.—Prenatal influences.

1. Conception.
2. Embryology.

3. Various facts and phenomena.
4. Influence of the first offspring on the female.

X.—Relative influence of the Parents.

1. On the improvement of a herd or on the stock of a district.
   a. The male parent the most potent in such improvement.
   b. This simply because he is the parent of a more numerous progeny.
2. On the individual offspring.
   a. Various theories and hypotheses that have been held.
   b. Orton's theory of the relative influence of the male and female parents on the progeny.
   c. Similar theory by Linnæus.
   d. Relation of these theories to pract'cal breeding.
   e. Application in breeding horses.
   f. In breeding sheep for wool.
   g. In breeding cows for milk.
   h. In breeding cattle for beef or draught.
3. Influence of the age of the parents.
4. Influence of their condition as to flesh.
5. Attempts to control the production of the sexes in offspring.

XI.—Breeding In and In.

1. Its advantages and why practiced.
2. For fixing characters.
3. For augmenting excellences.
4. Illustrations from Short-Horn Herd Book.
5. Relations to Atavism.
6. Its limitations and dangers.
7. Effects on constitution.
8. Its effects very unlike on different breeds.
9. Suggestions from Nature.

XII.—Crossing.

1. Crossing for constitution.
2. Crossing for flesh.
3. Crossing for wool.
4. Crossing for other special purposes.
5. Violent crossing.
6. Relations to Atavism.
7. Stability of grades.
8. Relations to Hybridism.
9. How new breeds have originated in crosses.

XIII.—Relation of Breeds to Locality.

1. Relations to climate.
2. Relations to food.
3. Relations to markets.
4. Why breeds that are profitable in one place are unprofitable in another.
5. The best breeds are very artificial productions.

6. They are adapted and bred to special uses.
7. Their superiority only kept up by good breeding and care.
8. For highest profit in special uses special breeds must be used.
9. Each locality must determine for itself by experiment what breeds are most profitable for its uses.

OTHER LECTURES.

TOPICS.

I.—Forage Plants.

1. Belong to many orders of plants.
2. The grasses, however, preëminently useful.
3. Turf or sod, conditions necessary.
4. Relations to climate.
5. Natural pastures.
6. Seeding.
7. So-called "Artificial Grasses."
8. Clovers, Sainfoin, Spurry.
9. Lucerne or Alfalfa.
10. Plants for soiling.
11. Roots, beets, turnips, carrots.
12. Results of inquiries and correspondence begun in eighteen hundred and sixty, relating to forage plants for hot climates, in respect to the wants of California, and extending to South America, Australia, Southern Europe, Northern Africa, and Western Asia.
13. Lucerne (or Alfalfa) oftenest recommended as the best.

II—Parasitic Diseases of Crops.

1. The nature and effects of parasitic fungi.
2. The Potato Rot—its history.
   a. What is known of its causes.
   b. Proposed remedies.
   c. All unsatisfactory.
   d. Proposed ameliorations.
3. The Grape Mildew of Europe.
   a. Its history, causes, and effects.
   b. Its remedies.
4. Rust in Wheat.
   a. Natural history of the disease.
   b. How it affects the crops.
   c. No remedy.
   d. Proposed methods of partial amelioration of effects.
5. Smuts—their history and effects.
   a. Smut in Wheat.
   b. Remedies.

In addition to the strictly Agricultural lectures, two lectures were given to the Engineering classes "On the Use of the Barometer in the Determination of Heights, as employed in this State and the Rocky Mountains."

On Coal as a Raw Material, at Berkeley and San Francisco.
The Rocky Mountains, at Berkeley and San Francisco.
The Sierra Nevada, at Berkeley and San Francisco.
The Physical Geography of the Eastern States, at Berkeley.
Modern Glaciers, at San Francisco.

REPORT OF THE SUPERINTENDENT OF GROUNDS.

WORK ON THE FARM AND GARDEN.

The Secretary of the University, Mr. R. E. C. Stearns, who is made by law the Superintendent of the Grounds, has had charge of this work with the coöperation of the Gardener, Mr. John Ellis, and the general approval of the Committee on Grounds appointed by the Board. The progress of the out-door work has been as follows:

On the first day of June, eighteen hundred and seventy-four, work in this department was commenced, and has been pursued with energy.

A portion of the grounds, some forty acres, dedicated to practical agriculture, has been thoroughly plowed, graded, and otherwise prepared, by deep trenching and working over, for nursery and other purposes.

Two propagating houses have been constructed, and were ready for use in the latter part of August, eighteen hundred and seventy four, and a commodious and convenient building for work-rooms, with suitable benches for potting and handling plants, constructed, with storage arrangements for prepared soil, pots, tools, etc., and a suitable office for gardener, and sleeping room for watchman.

The propagating houses are of the dimensions respectively of thirty by twenty feet and sixty four by fifteen feet, and in the rear of the latter is a laboratory pertaining to said houses, sixty-four feet in length by twelve feet in width; these buildings are arranged so as to facilitate the work, and so conveniently placed that the whole is easily supervised by the gardener.

The propagation of plants of economic value, as well as such species as are more particularly required for the purpose of illustrating general botany and ornamenting the grounds, in pursuance of the general plan devised by Mr. W. H. Hall, was at once commenced, and such vegetable forms as are valuable to the pomologist, and necessary to illustrate floriculture and arboriculture, have already been produced in large numbers. The entire domain belonging to the University includes two hundred acres, sloping to the west, a parallelogram in general shape, and presenting quite a diversified topography; its lower portion being about two hundred feet above the level of San Francisco Bay, and rising towards the east into hills, the summits of which are about nine hundred feet above the sea level. Some forty acres are reserved for agricultural purposes and experiments, and the remainder to illustrate the principles and methods of landscape ornamentation, forestry, botany, and allied studies.

A well designed and convenient barn, thirty-six by forty-four feet, and a story and a half in height, has been built, and the principal road which traverses the farming grounds has been marked out and partly graded, to facilitate the farm work.

The propagating houses were ready for use on the twenty-second of August, since which date ten thousand plants of twenty species of eucalyptus, five thousand acacias of twenty-five species, two hundred species of native and foreign Coniferæ, also numerous rare forms peculiar to Australasia, South and Central America, and elsewhere, and many species of textile, medicinal, and other economic plants, have been produced. We may mention one hundred and twelve varieties of roses, thirteen of azaleas, twelve of camellias, six of magnolias, for ornamental purposes.

The planting of a standard orchard, for the purpose of correcting the nomenclature of the fruits already in cultivation, and for furnishing hereafter scions and plants for distribution through the State, as well as for the introduction of new varieties to be distributed as above, has received proper consideration. The following have already been planted, and it is our intention to still further enlarge the list: apples, one hundred and forty-one varieties; Siberian crab-apple, fourteen varieties; pears, one hundred and fifty-two varieties; cherries, eighty-two varieties; plums, fifty-seven varieties; peaches, eighty-nine varieties; apricots, twenty-two varieties; quinces, two varieties; nectarines, fifteen varieties; grapes, seventy-three varieties; blackberries, seven varieties; gooseberries, eight varieties; currants, eight varieties; raspberries, thirty-four varieties; strawberries, thirty-five varieties; filberts, three varieties; asparagus, one variety; rhubarb, sixteen varieties; mulberries, six varieties; and all the species of walnuts and chestnuts. We have also procured many varieties of oranges, lemons, limes, etc.

Among the apples are nine new Russian varieties, and the peaches include seventeen of Rivers' new seedlings.

Our thanks are due to many friends for plants and seeds of desirable varieties, both of ornamental and useful plants, especially so to Mr. Regent Bolander, Mr. S. Nolan, Dr. A. Kellogg, Mr. W. J. Fisher (Naturalist of the Tuscarora Telegraph Sounding Expedition), and to Dr. C. L. Anderson, of Santa Cruz, Cal., for several choice species of willows, as well as to several other parties who have presented smaller lots.

It is not to be expected, with our local climate and soil, that all the above can be successfully grown at Berkeley, but it is altogether probable that many of them can be successfully cultivated, and we may be able to add more or less to the number of useful varieties now produced in the State.

COLLEGE OF MECHANICS.

GENERAL STATEMENTS.

Terms of Admission.—These are stated on a previous page.

Object of this Course.—This College educates mechanical engineers, machinists (as far as they are constructors of machinery), and others who wish to devote their energies to such technical and industrial pursuits as involve a knowledge of machinery.

Course of Study.—The full course of study of four years includes, like the other scientific colleges, two preliminary years, which give a general literary culture, beside the requisite mathematics.

The two advanced years give as much of the Civil Engineering Course as may be found necessary for the purposes of this College, including Mathematics, Physics, and Theoretical Mechanics. But the chief object will be to teach Applied or Industrial Mechanics; to show how the forces of nature are employed for industrial purposes; and to discuss the nature of the different constructions of machines contrived by human ingenuity.

Special attention is given to Industrial Drawing. The instruction in this department is directed in the advanced years to the construction of machinery as the principal object, and advances as the instruction in Applied or Industrial Mechanics advances.

Special Instruction in Applied Mechanics.—The Course of Applied or Industrial Mechanics during the third and fourth years is as follows:

THIRD YEAR.

1. Statics of Solids: General principles of statics; center of gravity; equilibrium of restrained bodies (elastic and rigid); friction and rigidity of chords; application of the principles of statics to resistance of material; neutral surface of a deflected beam; shearing and torsional resistance; strength of pillars; compound resistance.
2. Dynamics of Solids: Moment of inertia; centrifugal force; restrained motion under the influence of gravity; impact.
3. Statics of Fluids: Equilibrium and pressure of liquids; buoyancy; molecular action of water; equilibrium and pressure of air.
4. Dynamics of Fluids: General principles of discharge; influence of contraction and friction; flow through pipes; influence of sudden change in cross section; discharge under variable pressure; discharge and flow of air; motions of fluids of varying density; reaction and impact.
5. Application of mechanics to statical structures, with special reference to the construction of machines.

FOURTH YEAR.

General introduction to the application of mechanics, power, useful effect, work.

Prime Movers: Recipients for animal power, and that of water and wind; dynamometers; animal power; application of hydraulics to the reception and discharge of water (as used for water-power); vertical water-wheels; horizontal wheels (turbines); water-pressure engines; windmills.

Heat, Steam, and Steam Engines: Mechanical equivalent to heat; properties of steam, and appliances for its generation; steam engines; heat engines in general, and their efficiency.

Elementary Forms of Mechanism: General principles; interposed mechanism or communicators; wheel work, producing motion by rolling and wrapping contact; mechanism for modifying motion; screw; camb; producing motion by sliding contact; unusual means employed for modifying motion; variable motion by rolling contact; regulators and accumulators of motion.

Working Machines—

1. Hoisting and transportation: Lifting jacks, hydraulic press, hoists, hydraulic hoists, cranes, pile engine; application of hoisting machinery in mining; means employed for raising water.

2. Transmission of air by heat, compression or expansion, inertia and water.
3. Machines employed for change of form: Stamp mills, steam and tilt hammers, and so forth.
4. Machines used in the arts of construction and for domestic purposes: Excavator, dredging, drilling, and punching machines, sawmills, riveting machines, and so forth.

Books Recommended for Reference: Rankine's "Manual of Applied Mechanics," and Weisbach's Mechanics.

SCHEDULE OF STUDIES.

FOURTH, OR FRESHMAN CLASS.

First Term.—Mathematics—Algebra; French or German—(Begun); English—History and Structure of the Language; English Composition; Terminology; History; Drawing—Free-hand; Physiology—Lectures.

Second Term.—Mathematics—Geometry; Chemistry—Recitation and Laboratory Practice; French or German; English Composition; Rhetoric; Vocal Culture; History; Drawing—Free-hand; Physical Geography—Lectures.

THIRD, OR SOPHOMORE CLASS.

First Term.—Mathematics—Trigonometry, plane and spherical; Analytical Geometry; Chemistry; Physics—Heat; Botany; French or German; English Language—Minute History and Structure; English Composition; Mental Philosophy; Drawing—Free-hand and Industrial.

Second Term.—Mathematics—Analytical Geometry completed—Descriptive Geometry (Shades, Shadows, Linear Perspective, Isometric Projection); Chemistry; Physics; Mechanics; Zoölogy; French or German; English Language and Literature—Study of Masterpieces; English Composition; Drawing—Free-hand and Industrial.

SECOND, OR JUNIOR CLASS.

First Term.—Theoretical and Applied Mechanics—Lectures and Exercises; Zoölogy; Differential and Integral Calculus; German or French; History of English Literature; English Composition; Spanish or Italian—(Optional through the year); Drawing—Industrial.

Second Term.—Theoretical and Applied Mechanics—(Continued); Mechanics; Physics; Zoölogy; Geology; Integral Calculus and Calculus of Variations; German or French; History of English Literature; English Composition; Drawing—Industrial.

FIRST, OR SENIOR CLASS.

First Term.—Theoretical and Applied Mechanics—Lectures and Exercises; Theoretical Astronomy; Physics; Geology; German or French; Linguistics—Study of Language; English Composition; Modern History—Lectures; Moral Philosophy—Lectures; Drawing—Industrial; Spanish or Italian—(Optional through the year).

Second Term.—Theoretical and Applied Mechanics—(Continued); Physical and Practical Astronomy; Physics; Geology and Mineralogy; German or French; Linguistics; English Composition; Logic; Draw-

ing—Industrial; Political economy—Lectures; Law—Lectures; Thesis (Preparatory to graduation).

Instructions in the science of Mechanics has been given in the University by Professor John Le Conte since eighteen hundred and seventy, but for the further development of the College of Mechanics, two new instructors have recently been appointed—Professor Hesse and Professor Hoffmann; the former to give instructions in Industrial Mechanics, and the latter in Industrial Drawing. These gentlemen are regarded as qualified in a high degree to give efficiency to this part of the University. Professor Hoffmann's classes are already well organized, and he has begun a collection of diagrams and models which will prove very helpful in his work. An order has been sent to Darmstadt for a collection of Schroeder models illustrative of the elements of mechanism, to be purchased at an outlay of one thousand dollars, and their arrival may be soon expected.

Professor Hesse began his service after the work of the year was so far in progress that it was not easy at the moment to organize a class for his instruction, though he has offered to give special instruction to all who wish it.

In the meantime, he has undertaken to make an investigation which will undoubtedly have a very important bearing upon the industries of this State—an investigation of the strength of the timbers which are grown upon the Pacific Coast. Accurate information is very much needed on this subject by all who are concerned in the use of woods. In order to devise a successful mode of procedure, a meeting was held in February of the present year, which was attended by most of the scientific professors in the University, and by several well-known engineers and builders, whose pursuits had caused them to pay particular attention to the character of the woods of this coast. By their united suggestions, a plan was devised for the collection of specimens, and for determining accurately the circumstances of growth. By the agency of the Central Pacific Railroad and Wells, Fargo & Co., these specimens will be collected from every part of the State and brought to Oakland. Meanwhile, Mr. Hesse is engaged in the construction of the instruments by which the woods will be tested. The results of this work will be communicated to the Legislature, and will be published for the benefit of all who are engaged in any department of construction.

The following from Professor Hesse will give an idea of what he proposes to do:

"Having been intrusted with the management of the experimental inquiry relating to the woods of the Pacific slope, I deem it proper to give a short synopsis of the progress made so far, and of my aims as to its ultimate practical value.

"I am justified in stating, that with the coöperation of the Pacific Railroad Company and Wells, Fargo & Co., and the Scientific Department of the University of California, results can be obtained more comprehensive, and, I hope, more thorough, than any yet produced in the East or in Europe. Our slope is noted for the variety and quality of its timber, which has already attracted the attention of the manufacturing interests of Europe, and a knowledge of its properties will not only guide the manufacturer in its selection, but lead to new applications.

"Circulars, containing questions calculated to solicit every possible kind of information, have been printed for the use of the collectors. The specimens, consisting of entire segments of the trunk, will be forwarded to San Francisco to undergo the process of seasoning. This preparatory work will naturally extend over quite a period of time, during which the tests are being made as fast as the specimens can be furnished. The students will assist in the experimental tests, to get accustomed to the handling of instruments for experimental inquiry.

"At present I have been engaged in the construction of the necessary apparatus to make the following experiments:

"I. On the strength of direct cohesion of the fibres of wood.

"II. On the lateral adhesion.

"III. On the transverse strength.

"The mechanical action of the strain, which takes place in Test I, is by far the simplest, yet the most difficult to submit to actual experiments in wood. And it is to some extent owing to this circumstance that so little agreement is found in the experimental results obtained heretofore. For this reason it has been my especial aim in the construction of the apparatus to remove all the objectionable features which might prevent the obtaining of a reliable result. The main points which claimed my attention in this connection have reference:

"1. To the influence of vibration during the test.

"2. To the necessity of applying the strain in the direct line of the fibres and in the mathematical axis of the body to be tested.

"3. To adapt the apparatus to the testing of the lateral adhesion of the fibres of the wood.

"I am confident in stating that the plan I have adopted completely covers these points.

"The drawings are now in the hands of the pattern-makers, and I look to the completion of the test machine in a very short time.

"I may mention here, that I attach great importance to the Test II, for the following reasons:

"The recognized formula for transverse strength is probably correct only for that material which presents the same cohesive strength in every direction, as is generally found in homogeneous substances. In most woods we find a very different condition. The lateral cohesion is often one twentieth or less of the direct cohesion of the fibres. The established formula, which measures the resisting force directly by the breadth, the square of the depth, and inversely by the length, is based on theoretic considerations, embracing only direct cohesion and compression, and assumes that lateral cohesion is sufficient to resist the resultant shearing forces. I doubt the correctness of such general assumption, and believe, moreover, that the elasticity of the wood, under the action of forces parallel to the fibres (shearing forces), ought to be separated in the formula.

"I have for this reason consulted the tests which were made by Buffon, under the auspices of the French Government, as to the transverse strength of oak of various dimensions, and by far the most valuable ever made, both as respects the number and the size of the pieces of timber on which they were made.

"Now, if the old formula is correct, the constants computed from each of the above mentioned experiments ought to approximate the total average result. But I found that these coefficients decreased rapidly with an increase of the ratio of the depth with the length of beam, which seems practically to bear out the above assertion.

"I am at present engaged in the investigation of the distributed forces,

to establish, if possible, that relation above mentioned, and if successful, the results obtained from experiments can be applied so as to produce a more reliable result—a point of great practical utility."

The following circular has been issued in regard to this investigation:

"The University of California, with the generous coöperation of railroad engineers, and others practically interested in the investigations, proposes to make a thorough examination of the timbers grown and used on the Pacific Coast—especially for the purpose of ascertaining their strength, durability, and adaptation to various industrial, engineering, architectural, mechanical, and manufacturing purposes.

"The result of these investigations will be reported to the Legislature, and published for the benefit of the people in this State and at a distance. The suggestions and coöperation of scientific and practical men will be greatly appreciated.

"By the agency of the Central Pacific Railroad Company, Southern Pacific Railroad Company, and Wells, Fargo & Co., specimens will be collected and brought to the University. The mechanical tests will be made by F. G. Hesse, Oakland, Professor of Industrial Mechanics, and he will be assisted in other departments of the investigation by the Professors of Botany, Agriculture, Chemistry, Physics, and Engineering.

"In connection with this work, the collections of the University in Economic Botany and Vegetation will be increased. Interesting specimens for the Museum are solicited. Communications on the subject may be addressed to the Secretary of the University.

"NOTES TO ACCOMPANY EACH SPECIMEN.

"No.

"Collector's name.

"Date when cut.

"NAME OF TREE—Common and local. [If several names are known, mention them.]

"Botanical.

"PLACE WHERE GROWN—State, county, altitude. [Near summit, or foot of mountain, and on what side.]

"Whether native growth or cultivated.

"Whether isolated or surrounded by other trees of the same kind; if otherwise, state what kind of trees.

"Exposure.

"Nature of soil, moist or dry.

"Knowledge of the durability of wood.

"General condition of the tree, height, age, health, or soundness.

"DIRECTIONS FOR CUTTING—Cut segments of the trunk five feet long; one, from five to ten feet above ground, according to size of tree; another in middle, and one near top. Collect foliage, branches, and fruit (including acorns, cones, seeds, etc.), to ascertain the botanical name. Mark on each piece the number of the tree (corresponding with the label), the collector's name, and whether cut above ground, at the middle, or top; and also the north point of compass. Include forest trees, acclimated, and second growth."

COLLEGE OF MINING.

This department has recently been organized under the direction of Professor Ashburner, and its plans will be developed as rapidly as possible. During the coming year, Dr. Becker will instruct in Metallurgy, and Professor Hilgard will form a class in Mineralogy, and this will be in addition to the instructions given as heretofore by the Professors Le Conte, Rising, and others.

TERMS OF ADMISSION.

The requirements are the same as for the other scientific colleges, and are stated on a previous page.

COURSE OF INSTRUCTION.

The course of instruction occupies four years, leading to the degree of Bachelor of Philosophy in the College or Course of Mining. Students who desire to receive the degree of Mining Engineer must continue their studies for two years more, and must exhibit to the Faculty satisfactory evidence of their power to apply in actual work the knowledge they have acquired.

During the first two years of undergraduate work, the studies of the course are the same as those of the other scientific colleges in the University of California. During the last two years the attention is directed chiefly to Chemistry, Metallurgy, Geology, Mineralogy, and Engineering, though the study of modern languages is also kept up. The scientific studies are taught, as far as possible, with reference to their application in mining, and the entire work of the last two years is overlooked by the Professor of Mining, under whose special guidance the mining students come.

Opportunities are afforded to the class to visit some of the industrial establishments of San Francisco, and they are encouraged to extend their visits to mining and metallurgical works at a distance.

A prize of fifty dollars is offered for proficiency in this department of study, by the Professor of Mining.

The laboratories for work in Chemistry and Metallurgy are new, extensive, and well furnished. They afford excellent opportunities for becoming proficient in Assaying and Analytical Chemistry.

Aside from the laboratories in connection with the Colleges of Agriculture and Chemistry, which are well equipped in every respect, special laboratories, with furnaces, have been especially fitted up for practical instruction in metallurgical operations in the College of Mining.

The engineering instruments and the physical apparatus are also of the best kind.

SCHEDULE OF STUDIES.

FOURTH, OR FRESHMAN CLASS.

First Term—Mathematics—Algebra; French or English (Begun); English—History and Structure of the Language (Hadley); English Composition; Terminology; History; Drawing—Free-hand; Physiology—Lectures.

Second Term.—Mathematics—Geometry; Chemistry—Recitations and

laboratory practice; French or German; English Composition; Rhetoric; Vocal Culture; History; Drawing—Free-hand; Physical Geography—Lectures.

THIRD, OR SOPHOMORE CLASS.

First Term.—Mathematics—Trigonometry, plane and spherical, Analytical Geometry; Chemistry; Physics—Heat; Botany; French or German; English Language — Minute History and Structure (Earle); English Composition; Drawing—Free-hand and Industrial.

Second Term.—Mathematics—Analytical Geometry completed; Surveying and Irrigation; Chemistry; Physics; Mechanics; Zoölogy; French or German; English Language and Literature—Study of Masterpieces; English Composition; Drawing—Free-hand and Industrial.

SECOND, OR JUNIOR CLASS.

First Term.—Land and Mine Surveying and Leveling; Drawing of Plans and Mines; Chemistry; Mechanics; Zoölogy; Differential and Integral Calculus; German or French; History of English Literature; English Composition; Mental Philosophy; Spanish or Italian — (Optional through the year).

Second Term.—Drawing of Mining Machinery and Furnaces; Chemistry; Mechanics; Physics; Zoölogy; Geology; Integral Calculus and Calculus of Variations; German or French; History of English Literature; English Composition.

FIRST, OR SENIOR CLASS.

First Term. — Metallurgy; Mineralogy; Analytical Chemistry and Laboratory Work; Industrial Mechanics; Theoretical Astronomy; Physics; Geology; German or French; Linguistics—Study of Language; English Composition; Drawing—Mines and Machinery; Modern History—Lectures; Moral Philosophy—Lectures; Spanish or Italian—(Optional through the year).

Second Term.—Metallurgy; Mineralogy; Analytical Chemistry and Laboratory Work; Industrial Mechanics; Physical and Practical Astronomy; Physics; Geology; German or French; Linguistics; English Composition; Logic; Drawing—Mines and Machinery; Political Economy—Lectures; Law—Lectures; Thesis—(Preparatory to graduation).

The large collections of Rocks, Minerals, and Ores in the Museum, which is particularly rich in material of this class, will be of great value to the students in this College; and from the numbers of specimens, in many cases, duplicates can be spared for assaying or analysis.

During the past Academic year instruction was commenced in this College by means of a course of lectures on the useful metals, by Dr. George F. Becker, graduate of the Royal School of Mines, Berlin.

The following subjects were discussed: 1. Metallurgy as a Science. 2. Fuel, Refractory Material, and Furnaces. 3. Lead. 4. Copper. 5. Mercury. 6. Silver. 7. Gold. 8. Zinc. 9. Iron..

COLLEGE OF ENGINEERING.

SPECIAL STATEMENTS.

TERMS OF ADMISSION.—These are given on a previous page.

OBJECT OF THIS COLLEGE.—The object of this College is to give thorough instruction in those studies which pertain to the profession of a Civil Engineer. To a very considerable extent these studies are likewise preliminary to the profession of an Architect. They are also serviceable to all who wish proficiency in the application of Mathematics and Physics, either with reference to teaching or to other pursuits.

THE COURSE OF STUDY.—The full course of study includes two preliminary years, in which are given not only the requisite mathematics, but many branches of general literary culture, the same as in the other scientific colleges; and also two advanced years, in which the engineering and mathematical studies predominate. In the advanced years instruction is also given to the students of this College in Physics, Geology, Zoölogy, and in certain literary branches, including Modern Languages, History, and Political Economy, with the intention of promoting, as far as can be done in the limited time, professional excellence and intellectual culture.

THE SPECIAL INSTRUCTION IN ENGINEERING begins with the Surveying Course, including Land Surveying, Leveling, Topographical Surveying, Road and Railroad Surveying and construction, with computations of earthwork required by excavations, tunnels, and embankments. A liberal amount of time is allowed for exercise in the field, and the use of instruments, such as the compass, level, field transit, plane-table, etc., and in the working up and plotting of field notes. Topographical drawing and map-making are taught in connection with this part of the course. During the past year an accurate topographical survey has been made, by the class, of the grounds immediately surrounding the University buildings. This will be mapped by them, and the work continued by successive classes till the entire tract is accurately plotted. The use of the Aneroid and Mercurial Barometers is discussed, and practice given in the determination of heights, etc.

Journeys over the adjacent roads are made for the purpose of constructing itineraries, and of measuring and estimating distances by the eye alone, or with the ordinarily available means of assistance. Sketches will be made of the surrounding country; directions of hill ranges, streams, etc., will be taken as the basis of reconnaissance maps.

Students proficient in this course will be well fitted to undertake the work of Field Engineer.

In the fourth year of the course, the characteristics and properties of the various building materials, wood, stone, iron, steel, mortar, mastic, etc., their strengths, uses, and different methods of employment in structures, are discussed. The laws governing the construction of works of masonry, including foundations in dry and wet soils, and under water, stone bridges, dams, sewers, culverts, and retaining walls, are acquired.

Problems relating to the more difficult constructions of masonry, such as groined, cloistered, askew, and rampant arches, domes and walls

bounded by warped surfaces, etc., are solved, and by means of them working plans are drawn.

The principles and practice of framing, bridge and truss building, and the construction of estimates and working plans, are investigated, and the preparation of a careful thesis, on some topic in Engineering, selected or approved by the Professor of Engineering, terminates the undergraduate course, leading to the Degree of Bachelor of Philosophy (Ph. B.)

A practical bearing is given to the instruction of this year by the solution of interesting problems connected with the subjects taught; by visits to important structures, completed or in process of construction, which are accessible.

The beautifully varied nature of the grounds at and about the University, affords the finest field for practice in the various kinds of surveying; the department is well supplied with the necessary instruments, models, drawings, and maps, used in such instruction, and will avail itself of a generous gift of a citizen of Oakland, to further increase its collection.

Advanced or post graduate students, from this or other institutions, desirous of the degree of Civil Engineer (C. E.) will, in a two-years' course, complete their investigations of the subjects before enumerated, and will also take up the subjects of Geodetic and Hydrographic Surveys, mapping of extensive tracts of country, canals, drainage, irrigation; river, lake, harbor, and seacoast improvements; analyses and discussions of the most remarkable and exemplifying engineering structures, solutions of practicable problems, and preparation of original plans and estimates.

The completion of this part of the course will enable the student to pursue any branch of the wide field of Civil Engineering

Visits to Places and Objects of Special Interest to Engineers.—It is the intention of the Professor of Engineering, from time to time, as opportunity offers, to accompany his classes to places and objects of special interest to Engineers. Among the works visited, or to be visited, are the following:

The fortifications of earthwork and of masonry in or near the San Francisco Harbor.

The shops for preparing artificial stone.

The wood-preserving works.

Rolling mills and foundries.

Offices of Civil and Military Engineers.

United States Government buildings in San Francisco.

California Dry Dock.

United States Navy Yard at Mare Island.

McAdam and other roads in process of construction, stone quarries, and stone-breaking machines.

Golden Gate Park.

Spring Valley Waterworks and Reservoirs.

Acknowledgments from the University are due to the officers and Superintendents of the places visited, for their kindness and politeness in admitting students, and describing and explaining to them the various objects and processes seen.

SCHEDULE OF STUDIES.

FOURTH, OR FRESHMAN CLASS.

First Term.—Mathematics—Algebra; French or German—(Begun); English—History and Structure of the Language; English Composition; Terminology; History; Drawing—Freehand; Physiology—Lectures.

Second Term.—Mathematics—Geometry; Chemistry—(Recitations and laboratory practice); French or German; English Composition; Rhetoric; Vocal Culture; History; Drawing—Freehand; Physical Geography—Lectures.

THIRD, OR SOPHOMORE CLASS.

First Term.—Mathematics—Trigonometry, plane and spherical—Analytical Geometry; Chemistry; Physics—Heat; Botany; French or German; English Language—Minute History and Structure; English Composition; Drawing—Freehand and Industrial.

Second Term.—Mathematics—Analytical Geometry completed; Descriptive Geometry (Shades, Shadows, Linear Perspective, Isometric Projection); Chemistry; Physics; Mechanics; Zoölogy; French or German; English Language and Literature—Study of Masterpieces; English Composition; Drawing—Freehand and Industrial.

SECOND, OR JUNIOR CLASS.

First Term.—Land Surveying, Leveling, and Topography; Engineering Drawing; Mechanics; Zoölogy; Differential and Integral Calculus; German or French; History of English Literature; English Composition; Mental Philosophy; Spanish or Italian—(Optional through the year).

Second Term.—Road and Railroad Surveying and Building—Geodesy and Reconnaissances; Engineering Drawing; Mechanics; Physics; Zoölogy; Geology; Integral Calculus and Calculus of Variations; German or French; History of English Literature; English Composition.

FIRST, OR SENIOR CLASS.

First Term.—Properties of Building Materials; Engineering Drawing; Theoretical Astronomy; Physics; Geology; German or French; Linguistics—Study of Language; English Composition; Modern History—Lectures; Moral Philosophy—Lectures; Spanish or Italian (Optional through the year).

Second Term.—Framing, Bridge Building, and Foundations; Engineering Drawing; Physical and Practical Astronomy; Physics; Geology and Mineralogy; German or French; Linguistics; English Composition; Logic; Political Economy—Lectures; Law—Lectures; Thesis—(Preparatory to graduation).

Many additions to the apparatus and instruments requisite in this College have been purchased during the past year.

COLLEGE OF CHEMISTRY.

SPECIAL STATEMENTS.

TERMS OF ADMISSION.—The requirements are stated on a previous page.

OBJECTS OF THIS COLLEGE.—The course of instruction in the College of Chemistry is designed for those who wish to become professional chemists, either as teachers and investigators, or as metallurgists, assayers, and manufacturers in chemical industries; and also for those who wish to become expert chemists preparatory to the pursuit of medicine, pharmacy, mining, etc.

The students of the Colleges of Agriculture, Mining, etc., have also the advantages of the Chemical Laboratory, but give a less amount of time to laboratory work than those who are especially enrolled in the College of Chemistry. Elementary instruction is also given to literary students.

THE COURSE OF STUDY.—The full course of study of four years includes the same preliminary instructions as are given in the other scientific colleges, except that in the third term of the second year the student may take Surveying or Crystallography in place of Descriptive Geometry. It includes, also, during the third and fourth years, instructions in Physics, Geology, Zoölogy, and in certain literary branches, including Modern Languages, History, and Political Economy.

The special teaching in Chemistry may be thus described:

Instruction is given in general and theoretical chemistry by lectures, recitations, and laboratory practice. This course extends through three terms—one in Freshman year and two in Sophomore year—and embraces the elements of inorganic and organic chemistry. Students, after making themselves familiar with the details of experiments, are required to repeat the same in the laboratory for elementary chemistry.

An advance course of lectures will be given to students of the Junior and Senior classes, in general and theoretical chemistry. This course will embrace a discussion of the general principles of the science, and their application to analytical and metallurgical chemistry, and to mineralogy.

The chemical laboratories will be open daily for instruction in analytical chemistry.

The course of instruction in qualitative analysis will include the analysis of simple and complex substances in the wet way, their analysis by the use of the blow pipe and flame reactions, and the determination of minerals with the blow-pipe. Students will be required to keep a careful record of their work, and to submit the same to the inspection of the Professor. Upon passing a satisfactory examination in qualitative analysis, students may pass to the quantitative laboratory.

In the quantitative laboratory instruction will be given in the quantitative gravimetric analysis of simple and complex salts, minerals, ashes of plants, mineral waters, etc.; in volumetric analysis, including acidimetry, alkadimetry, chlorimetry, etc.; in organic analysis; in gas analysis; in the preparation from inorganic and organic compounds, and in the carrying out of original investigations.

Students taking the course of chemistry will be expected to spend at least fifteen hours a week in the laboratory during Junior year, and twenty hours a week during Senior year.

Every opportunity possible is made use of to give instruction in those branches of chemistry which have a practical application to the arts.

For example, a room for the study of photography, in connection with the chemical laboratory, will be opened as soon as the necessary apparatus can be supplied.

Practical instruction in electro-metallurgy will be given to such students as desire it.

Students in Agriculture will receive special instruction in the analysis of manures, including the determination of phosphoric acid and nitrogen, etc.

So far as practical, students will be employed in the preparation of chemicals used in the laboratories; the object being to give them as much practice in manufacturing chemistry as is possible.

Special training in the analysis of mineral waters will be given to such of the advanced students in chemistry as may desire it.

Careful lists of waste products, minerals, etc., which may be utilized, will be kept, and students instructed in methods of saving them.

SPECIAL STUDENTS IN CHEMISTRY.—The advantages of the laboratory and lectures are open not only to those who pursue a full course of instruction, but to those who wish for a short period to pursue some special course, or carry on some special investigation. It should, however, be understood, that this permission is not designed to furnish a means of escape from regular courses of study, but is for the benefit of persons who are already somewhat advanced in knowledge, and who desire to become acquainted with modern chemistry.

VISIT TO CHEMICAL ESTABLISHMENTS.—It is the intention of the Professor of Chemistry to encourage the students to visit the various chemical and metallurgical works of the vicinity, so far as this is practical.

THE CHEMICAL LABORATORY.—The Chemical Laboratory, at Berkeley, has been fitted up at a large expense, and in accordance with the best experience of European and American laboratories. There are two main rooms, an upper and a lower room. The former is intended for quantitative analysis and original investigations, and has accommodations for thirty-two students. Adjacent to it are the laboratory and study of the Professor of Chemistry, the balance room, and the fusion room. The lower room is intended for quantitative analysis, and has also accommodations for thirty-two students. Adjacent to it is a room for the instruction of literary and other students in elementary chemistry. The laboratories are open daily, including Saturdays.

CHARGE FOR CHEMICALS.—Students may be supplied with the necessary apparatus for chemical analysis from the laboratory. This will be charged to them, and may be returned to the laboratory if uninjured. Students will provide themselves with platinum ware and weights.

A charge is made for chemicals used in chemical analysis. Students needing assistance, who are able and willing to render service in return for chemicals, can make application to the Professor.

SCHEDULE OF STUDIES.

FOURTH, OR FRESHMAN CLASS.

First Term.—Mathematics—Algebra; French or German (Begun); English—History and Structure of the Language (Hadley); English

Composition; Terminology; History; Drawing—Freehand and Instrumental; Physiology—Lectures.

Second Term.—Mathematics—Geometry; Chemistry—(Recitations and laboratory practice); French or German; English Composition; Rhetoric; Vocal Culture; History; Drawing; Physical Geography—Lectures.

THIRD, OR SOPHOMORE CLASS.

First Term.—Mathematics—Trigonometry, plane and spherical, Analytical Geometry; Chemistry; Physics—Heat; Botany; French or German; English Language—Minute History and Structure (Earle); English Composition; Drawing.

Second Term.—Mathematics; Descriptive Geometry; Surveying and Irrigation; Chemistry; Physics; Mechanics; Zoölogy; French or German; English Language and Literature—Study of Masterpieces; English Composition; Drawing.

SECOND, OR JUNIOR CLASS.

First Term.—Inorganic Chemistry—Lectures; Analytical Chemistry; Mechanics; Zoölogy; Differential and Integral Calculus (Optional); German or French; History of English Literature; English Composition; Mental Philosophy; Spanish or Italian (Optional through the year); Drawing (Optional through the year).

Second Term.—Inorganic Chemistry—Lectures; Analytical Chemistry; Mechanics; Physics; Zoölogy; Geology; Integral Calculus and Calculus of Variations (Optional); French or German; History of English Literature; English Composition.

FIRST, OR SENIOR CLASS.

First Term.—Organic Chemistry—Lectures; Analytical Chemistry; Physics; Geology; Astronomy; French or German; Linguistics—Study of Language; English Composition; Modern History—Lectures; Moral Philosophy—Lectures; Spanish or Italian (Optional through the year).

Second Term.—Organic Chemistry—Lectures; Analytical Chemistry; Physics; Geology; Mineralogy; French or German; Linguistics; English Composition; Logic; Political Economy—Lectures; Law—Lectures; Thesis (Preparatory to graduation).

Many improvements in and additions to the Chemical Laboratories and the implements used therein, have been made since the last report.

COLLEGE OF LETTERS.

SPECIAL STATEMENTS.

Objects.—The College of Letters maintains two courses; one of them corresponding to the classical course with which the public are familiar; and the other giving prominence to the modern languages, history, and literature. The former, which is known as "the Classical Course," leads to the traditional degree of Bachelor of Arts; the latter, which is known as "the Literary Course," leads to the degree of Bachelor of Philosophy. In both these courses a liberal amount of time is bestowed

upon the principles of modern science. The students attend the lectures on Botany, Zoölogy, Geology, Chemistry, Mechanics, and Physics. They are also carried through the study of Mathematics, so as to become acquainted with Algebra, Geometry, and Analytical Geometry.

One or the other of these two courses will be found adapted to those who desire to lay a broad foundation of literary, historical, and scientific culture as a basis for further professional study. Those who expect to become teachers, will notice the adaptation of these courses to their future vocation.

THE CLASSICAL COURSE.

Terms of Admission.—The terms of admission to the Classical Course are as follows:

Candidates must pass a satisfactory examination in the same studies as candidates for the Colleges of Science, and in the following *additional* studies: *Latin Grammar*, including prosody; *Cæsar*, four books; *Virgil*, Eclogues, and six books of the Æneid; *Cicero*, six orations; *Greek Grammar*, including prosody; *Xenophon's Anabasis*, three books; *Homer's Iliad*, two books (omitting the catalogue). After eighteen hundred and seventy-five, the requisition in Virgil will be increased by the addition of the Georgics, and that in the Anabasis to four books. For the latter, equivalents will be accepted from Goodwin's Greek Reader.

Some practice in Latin composition is very important. The study of Greek composition is also strongly recommended to those who are preparing for this course. After eighteen hundred and seventy-five, candidates will be examined in the first twenty-six lessons of Allen's Latin Composition, and in Jones' Greek Composition; or in their equivalents.

Candidates for advanced standing, whether from other Colleges or not, in addition to the preparatory studies, are examined in those already pursued by the classes which they propose to enter.

Applicants should be at least sixteen years of age, and bring satisfactory testimonials.

Outline of the Course.—An outline of the course may thus be given:

In Latin, the authors read are Livy (History), Horace (Odes, Epistles, and Satires), Cicero (on Old Age, on Friendship, on Oratory, the Oration for Cluentius, and Select Orations), Plautus (Captives), Terence (Andria), Tacitus (Life of Agricola, and other selections), Juvenal (Satires), and Quintilian (on Oratory).

In Greek, the student will read in Homer's Odyssey, in Heredotus (History), Plato (Phædo, Apology, Crito), Xenophon (Memorabilia of Socrates), in Thucydides (History), Æschylus (Prometheus Bound), Sophocles (Antigone), Euripides (Alcestis), Demosthenes (Oration for the Crown, and Select Orations), Aristophanes (the Frogs).

In Latin, the Grammars of Allen and Greenough and of Harkness are used, with reference to Madvig's. The first named is recommended to beginners. Hadley's Greek Grammar and Goodwin's Greek Grammar are used. The latter is recommended to preparatory classes. Equivalent portions of Goodwin's Greek Reader may be substituted for the parts of the Anabasis and the Iliad required for admission. Liddell and Scott's Greek Lexicon, and Andrews' or White's Latin Lexicon, are also recommended.

All the instruction in Latin and Greek aims to bring out the relations of those languages to our own.

Prominence is given in the classical course to such works, preceptive or illustrative, as bear on the art of public speaking.

Latin and Greek prose composition receive attention during the first two years.

Other studies are Ancient and Modern History (including the History of Civilization), the English Language, with constant practice in Composition, English Literature, Rhetoric, Logic, Mental and Moral Philosophy, German, and French.

Students in this course pursue the study of Mathematics through Algebra, Geometry, Analytical Geometry, Surveying, and Mechanics.

In Science, they pursue the study of Physics, Botany, Zoölogy, Geology, Chemistry, Mineralogy, and Astronomy.

There are courses of lectures on English and Ancient Literature, Greek and Roman Geography, Mythology and Archæology, Greek Politics, Political Economy, Physical Geography, and Law.

SCHEDULE OF STUDIES.

CLASSICAL COURSE.

FOURTH, OR FRESHMAN CLASS.

First Term—Latin—Livy, Latin Composition; Greek—Homer's Odyssey, Herodotus; Mathematics—Algebra; English Language—History and Structure (Hadley); Ancient History—Lectures; Written Translations; Lectures on Physiology; Physical Geography of the Mediterranean Countries—Lectures; Greek and Roman Geography—Lectures.

Second Term—Latin—The Odes and Epistles of Horace; Greek—Herodotus continued, the Phædo of Plato, Greek Composition; Mathematics—Algebra completed, Geometry; English Composition; Rhetoric; Vocal Culture; Ancient History—Lectures; The Classical Side of English—Lectures.

THIRD, OR SOPHOMORE CLASS.

First Term—Latin—Cicero, De Senectute, De Amicita, Select Orations, Extemporaneous Translations, Latin Compositions; Greek—Memorabilia of Xenophon—Thucydides—Greek Composition; French—(Begun); English Language—History and Structure: (*Earle*); English Composition; Mathematics—Geometry, completed; Physics—Heat; Botany; Latin Authors—Lectures on those already studied.

Second Term—Latin—The Captives of Plautus—the Andria of Terence; Greek—Thucydides, continued—the Apology of Plato; French; English Language and Literature—Study of Masterpieces; English Composition; Mathematics—Trigonometry, plane and spherical; Physics; Mechanics; Zoölogy; Greek Authors—Lectures on those already studied.

SECOND, OR JUNIOR CLASS.

First Term—Latin—The Ars Poetica of Horace—the Agricola of Tacitus—Extemporaneous Translations; Greek—The Prometheus of Æschylus—the Crito of Plato; German (Begun); French; History of English Literature; English Composition; Mental Philosophy; Mechanics; Zoölogy; Surveying; Spanish, Italian, or Hebrew—(Optional through the year); Greek and Roman Mythology—Lectures.

Second Term—Latin—The Satires of Horace—Juvenal; Greek—the Antigone of Sophocles—the Alcestis of Euripides; German; French; History of English Literature; English Composition; Mechanics; Physics; Zoölogy; Geology; Chemistry—Lectures; Analytical Geometry; Greek and Roman Archæology—Lectures.

FIRST, OR SENIOR CLASS.

First Term—Latin—Cicero and Quintilian, in Kellogg's "Ars Oratoria;" Greek—Demosthenes on the Crown; Linguistics—Whitney's Language and the Study of Language; English Composition; History of Civilization; Moral Philosophy—Lectures; Physics; Geology; Astronomy; Ancient Literature—Lectures.

Second Term—Latin—Cicero pro Cluentio; Greek—Select Orations; German; Linguistics—Study of Language; English Composition; Logic; Political Economy—Lectures and Discussions; Physics; Geology; Law—Lectures; Greek Politics—Lectures; Thesis—(Preparatory to graduation).

THE LITERARY COURSE.

TERMS OF ADMISSION.

The terms of admission to the Literary Course are the same as for the Colleges of Science, and are stated on a previous page. In addition, it is expected that the applicant will exhibit a proficiency in some language besides the English. Latin is strongly recommended; and a deficiency in this language must be made up during the course. After eighteen hundred and seventy-six, preparation in Latin will be a condition of entrance.

OUTLINE OF THE COURSE.

An outline of this course may thus be given:

During the first two years the Literary Course is almost identical with the first two years of the Scientific Course. French or German is studied in the first year, and both languages in the second year. Algebra, Geometry, and Analytical Geometry, are also studied. The study of Botany, Zoölogy, and Natural Philosophy is pursued. Those who have not already become acquainted with Latin, are expected in the first two years to acquire a knowledge of it. Special attention is paid to Drawing.

Under the head of English Literature, special attention will be given in the last two years to written exercises in the various departments of literary effort—such as Forensic Disputes, Criticisms, and Reviews, Philosophical Essays, etc. Journalistic training will be aided by the study of the periodical press, both at home and abroad, and by practice in the direction of magazine and leading articles, the discussion of current events, questions of public policy, and the like. Opportunities will be afforded in the last year of the course for practical culture in such departments of literature as the special taste or purpose of the student may require.

The text books specified in the following schedule are indications of the character of the works to be used in connection with the course. They may not always be taken up in the order named, nor be made the basis of daily recitations.

Scientific studies are pursued through the course. In this, more than

in any of the other courses, the Modern Languages, History, and Literature receive particular attention.

FOURTH, OR FRESHMAN CLASS.

First Term—English Language—History and Structure (Hadley); Composition—Description, Narration; Mathematics—Algebra; French or German—(Begun); Chemistry—Text-book and laboratory; The Culture of the Intellect—Lectures; Terminology; History—Lectures; Physiology; Drawing—Free hand and Instrumental.

LATIN.

Students who enter this course without a knowledge of Latin, will be required to study it during the first two years.

Second Term.—Rhetoric; Composition—Exposition, Argument; Mathematics—Algebra, Geometry; French or German; Chemistry—Text-book and laboratory; History—Lectures; Lectures on Books; Physical Geography—Lectures; Drawing.

THIRD, OR SOPHOMORE CLASS.

First Term—English Language—History and Structure (Earle); Composition—Exposition and Argument, Imaginative, etc.; Mathematics—Geometry; French; German; Physics; Chemistry—Lectures and laboratory; Botany—Lectures; Library Work, with Lectures; Drawing.

Second Term.—English Language and Literature—Study of Masterpieces; Composition—Account of books read, historical investigations, etc.; Mathematics—Trigonometry; French; German; Physics; Chemistry—Lectures and laboratory; Zoölogy—Lectures; Latin Authors (with Classical Course)—Lectures; Drawing.

SECOND, OR JUNIOR CLASS.

First Term—Anglo-Saxon Grammar; History of English Literature; Composition—Literary Biography, Sketches, prose or verse, etc.; Mental Philosophy; Mathematics—Surveying; German; French; Spanish or Italian (optional); Greek and Roman Mythology—Lectures; Constitutional History; Zoölogy—Lectures; Mechanics.

Second Term.—Anglo-Saxon and Early English Literature; History of English Literature; Composition—Character Studies, Literary Criticism, etc.; Mental Philosophy; Mathematics—Analytical Geometry; German; French; Spanish or Italian—(Optional); Greek and Roman Archæology—Lectures; Zoölogy; Geology; Mechanics.

FIRST, OR SENIOR CLASS.

First Term—English—Select Prose; Composition—Special—Investigations—Political Æsthetics, Philosophical; Linguistics—Whitney's Language and Study of Language; Ancient Literature—Lectures; History of Civilization—Guizot, Bryce, Freeman, etc.; Political Economy—Lectures and Discussions; Moral Philosophy—Lectures; German—Select Authors; French—Select Authors; Spanish or Italian—(Optional); Astronomy; Geology—Lectures; Physics—Lectures; Mathematics—Differential and Integral Calculus—(Optional).

Second Term—English—Select Poetry; Composition—Philosophical, Literary, Oratorical; Logic; History—Comparative Politics (Freeman)—Maine's Ancient Law, Hadley's Roman Law; Literary Art—Lectures; Comparative Language—Lectures; Social Science—Lectures and Discussions; German—Select Authors, History of Literature; French—Select Authors, History of Literature; Physics—Lectures; Lectures on Law; Mathematics—Differential and Integral Calculus—(Optional); Thesis—(Preparatory to graduation).

PUBLIC LECTURES.

Since the organization of the University, special efforts have been put forth by the authorities to awaken an interest in the work of the University, by means of public lectures upon scientific subjects. In addition to the voluntary work of the various professors, who have been called upon from time to time to go to the different towns in the State, one of the professors, the Professor of Agriculture, was instructed by the Regents to go about the State, and deliver lectures on the subjects to which he was specially devoted; and for six successive years a course of public lectures has been given every Winter in San Francisco, at the rooms of the Mechanics' Institute, by various members of the Faculty.

An assembly of the students of all departments is held on every Friday afternoon—at which announcements and instructions of general interest are communicated. The various professors and instructors in their turn have given lectures on these occasions, and not infrequently gentlemen who are not connected with the University have been invited to lecture. This appointment has been found quite acceptable to the friends of the University and of the students, who avail themselves of this opportunity to visit Berkeley.

The Regents of the University made arrangements during the session of eighteen hundred and seventy-four-five, for the delivery at Berkeley of various special lectures upon subjects relating to the Useful Arts, and Historical and Literary subjects.

These lectures were in addition to the systematic and prolonged instruction given to the classes, by the Professors in Agriculture, Geology, Physics, Mechanics, Chemistry, Engineering, and other branches of study.

These special lectures were opened to all who wished to attend them, whether members of the University or not, and were largely attended.

Many of the lectures were reported in the San Francisco *Bulletin*, *Mining and Scientific Press*, and the *Rural Press*, as well as in other papers.

Professors Becker, Bessey, and Brewer also lectured on Saturday evenings before the Mechanics' Institute, in San Francisco, under the auspices of the University.

LECTURES ON THE USEFUL ARTS.

Lectures on the Useful Metals, by Dr. George F. Becker.
On Mining as a Profession, by William Ashburner.
On the Science of Mechanics, by Frederick G. Hesse.
On Industrial or Mechanical Drawing, by John D. Hoffmann.

On Carniverous Plants, by Professor C. E. Bessey, of the Iowa Agricultural College.
On Wheat, by Horace Davis, Esq., of San Francisco.
On the Timbers in Common Use, by Professor C. E. Bessey, of the Iowa Agricultural College.
On Coal as a Raw Material, by Professor W. H. Brewer, of the Sheffield Scientific School of Yale College.

LECTURES ON LITERARY AND HISTORICAL SUBJECTS.

On the Study of Modern Languages, by P. Pioda, Professor of Modern Languages.
On the Study of English, by E. R. Sill, Professor of English.
On the Study of Spanish, by C. F. Gompertz, Instructor in Spanish.
On Schiller's "Song of the Bell," by A. Putzker, Instructor in German.
On the Crimean War (in French), by G. de Kersaint-Gily, Instructor in French.
On Gesture Langnage, by Professor Wilkinson, Principal of the California Institution for the Deaf, Dumb, and Blind, Berkeley.
On the History of Explorations of the Rocky Mountains, by W. H. Brewer, Professor in Yale College.

LECTURES ON OTHER SUBJECTS.

The Sierra Nevada Mountains, by Professor W. H. Brewer.
The Physical Geography of the Eastern States, by Professor W. H. Brewer.
On Natural History and the Theory of Evolution, by Professor E. S. Morse, of Bowdoin College.
Modern Glaciers (in San Francisco, only), by Professor W. H. Brewer.
In addition to the foregoing, lectures were delivered by Honorable F. F. Low (late United States Minister in China), Rev. Charles Kingsley (Canon of Westminster), President Miner (of Tufts College), Rev. Dr. G. B. Bacon, and Dr. W. P. Gibbons.

It should be borne distinctly in mind that it is not supposed these lectures will in any way supersede the systematic instruction which is given by the permanent professors, nor that they are as useful to the students as the instruction of their ordinary and regular teachers; but that while the staff of the University is so small, it is an advantage to strengthen it by calling in from time to time gentlemen who have been interested in various specialties.

FIELD EXCURSIONS.

The first of a series of proposed field excursions occurred during the Spring recess, and was placed in charge of Professor Joseph Le Conte.

The Regents agreed to pay the expense of transportation and forage, and to furnish such necessary equipment as the University could supply. A report from the officer in charge and of his assistant, Instructor Hawkins, has been made to the office and properly filed.

Professor Le Conte says: "I have no hesitancy in saying that the young men acquired really valuable knowledge." The reports have been published in full in the student's paper, *The Berkeleyan.*

As the expense incurred for this highly important field instruction is small, the Regents will encourage the same to a reasonable extent.

COLLEGE OF MEDICINE.

Clinical Instruction.—In connection with the lectures there have been established a Medical and Surgical Clinic, a Clinic of Diseases of the Eye and Ear, a Clinic of Diseases of Women, and an Obstetrical Clinic at the City and County Hospital, where, throughout the course, diseases in all their varieties and stages may be studied at the bedside.

A patient is placed in charge of a senior student, and by him examined, a diagnosis and prognosis given, together with his views of treatment in the presence of the class; after which, all errors of investigation, conclusion, or suggestion in treatment are corrected, with such remarks upon the subject as may be pertinent to practical medicine, etc.

Every student, thus detailed, is expected to keep a complete history of the case, in due form, for his own and lecturer's use.

Clinical Lectures will be given on Monday, Wednesday, and Friday of each week, on Practice of Medicine, Surgery, Special Pathological Anatomy, Physical Diagnosis, Auscultation and Percussion, Diseases of Women, and Diseases of the Eye and Ear, at the College.

The Surgical Clinic is under the direction of Professor Toland.
The Medical Clinic, under Professor Bates.
The Obstetrical Clinic, and the Clinic of Diseases of Women, under Professor Cole.
The Clinic of Diseases of the Eye and Ear, under Professor Martinache.

The Museum.—The Museum of the College has recently received large accessions to its collection of wet and dried preparations, in the various departments, together with extensive additions in wax and papier mache, fitted for illustrating the Lectures.

Special Branches of Study.—The following branches are annually taught. Principles and Practice of Medicine, Anatomy, Physiology, Surgery, Chemistry, Materia Medica, Clinical Surgery, Clinical Medicine, Pathology, Midwifery, Diseases of Women and Children, Medical Jurisprudence, Clinical Diseases of Women, Clinical Midwifery, Ophthalmology, Otology, and Hygiene.

Principles and Practice of Medicine.—It will be the aim of the lecturer in this department to impart to the student the most important practical knowledge, to present in his lectures a summary of those facts and principles which are embraced in the practice of medicine at the present time, and which furnish the only safe guide to the medical man.

He will endeavor to give a faithful description of diseases, their etiology, symptoms, diagnosis, prognosis, lesions, and treatment. He will convey to the student a knowledge of the pathological changes which occur in different diseases, by means of plates, various preparations, and by recent specimens of diseased parts. A medical clinic will also be given at the City and County Hospital, where the student will have an opportunity of testing, by the evidence of his senses, those facts and principles which have been taught in the lecture-room. Every effort will be made to impart practical instruction in the diagnosis and treatment of diseases.

Especial attention will be given to the diagnosis of diseases of the chest, by auscultation and percussion.

CHEMISTRY.—All important principles in chemistry will be illustrated by means of suitable philosophical, chemical, and other apparatus, for that purpose, and facts and theories will be presented in a clear and comprehensive manner.

Toxicology will receive that careful attention which its medico-legal importance demands.

PHYSIOLOGY.—The lectures in this department will embrace a consideration of both general and special physiology, including all that has been developed through the microscope, up to the present time, and will be illustrated by the largest and most complete series of colored drawings in the United States, prepared expressly for these lectures.

These drawings have been furnished, and are designed to convey to the mind of the student, ideas which it is impossible to communicate by language alone.

When expedient the microscope will be used for illustrating important facts and principles, and the student will not only receive instruction in theory, but in the means of arriving at facts in this important science.

ANATOMY.—The lectures on Anatomy are fully illustrated by preparations (wet and dried) and by the *cadaver*.

The Dissecting Room has been entirely refitted and furnished so as to facilitate the prosecution of the study of Practical Anatomy, and will be constantly supplied with an abundance of material.

SURGERY.—Instructions in this department embrace: First—A regular course of lectures on the principles and practice of surgery. Second—Demonstrative surgery upon the *cadaver;* and Third—A thorough clinical course, including diseases of the genito-urinary apparatus, at the County Hospital and College building.

OBSTETRICS.—In this course there will be no lack of effort to bring every thing pertaining to this department as clearly and practically before the mind of the student as the present state of the science will admit.

The lectures will be amply illustrated by colored drawings, many of which have been taken from nature, and also by wet preparations. The different operations in obstetrics will be performed upon a manikin, and the student will be instructed and practiced in the use of obstetrical instruments, besides enjoying the opportunity of visiting the Lying-in-Hospital and applying to practice principles which have been taught in the lecture-room.

MATERIA MEDICA AND PHARMACY.—It will be the aim of the Professor of Materia Medica to bring before the class all that is of importance, and bears the impress of truth, connected with this department, in such a manner as to be readily comprehended by the student.

The lectures will be illustrated by colored drawings, by the exhibition of the various medicinal substances in the use at the time describing them, and by demonstrating their reactions and combinations.

Recent plants will be presented and described, when expedient, particularly those which are indigenous to our soil, of which there are many varieties scattered over this vast region, possessing great therapeutic value, a knowledge of which is indispensable to the practitioner of medicine in this country.

DISEASES OF WOMEN.—This department, which has made within the past few years such rapid strides towards thorough development, and which has recently received so much attention at the hands of the Profession, will be fully taught, both didactically and clinically.

MEDICAL JURISPRUDENCE AND MENTAL DISEASES.—The lectures in this department will exhibit the principles of legal medicine and the duties of medical men as experts in giving testimony in Courts of justice, and in the examination of medico-legal questions; will embrace a view of insanity, suicide, infanticide, legitimacy, poisoning, death and injury from violence, feigned sickness, duties of Coroners, and other topics of practical importance, whether to the student of medicine or of law; together with a thorough course on the various diseases of the mind, so common in this State.

OPTHALMOLOGY AND OTOLOGY.—The great and growing importance of Diseases of the Eye and Ear, and the extensive discoveries and improvements recently made in those departments, have led to the establishment of a Professorship of Opthalmology and Otology. The students will have frequent opportunities of witnessing operations of different kinds, particularly on the Eye, and will be instructed in the use of the Opthalmoscope and other instruments, in the diagnosis and treatment of the diseases of these organs. For this purpose a proper room has been specially furnished and fitted, and the students will be taught their use practically.

REQUIREMENTS AND REGULATIONS.—The examinations will be so arranged as to permit the commencement for conferring degrees to be held early in November.

The candidate must be of good moral character, and at least twenty-one years of age.

He must have attended two full courses of lectures in some regular and recognized medical school, one of which shall have been in this College, and he must exhibit his tickets, or other sufficient evidences thereof, to the Dean of the Faculty.

He must have studied medicine for not less than three years, and have attended at least one course of practical anatomy in the dissecting room, and one course of clinical instruction in an institution approved by the Faculty.

He must present to the Dean of the Faculty a thesis or dissertation upon some medical subject, in his own handwriting and of his own composition; and exhibit to the Faculty, at his examination, satisfactory evidence of his professional attainments.

FEES.—The aggregate fees for tickets to all the lectures during the regular term, including instruction at the various hospitals, will be one hundred and thirty dollars. Tickets for one or any number of the departments of instruction may be had separately.

The matriculation fee is five dollars, to be paid but once.

The graduation fee is forty dollars.

The dissecting fee is ten dollars.

BENEFICIARIES.—For the purpose of assisting meritorious young men, the Faculty will receive annually a limited number of beneficiaries, who will be required to pay *fifty dollars* each towards the support of the institution, together with the matriculation fee.

Those who are desirous of availing themselves of this foundation, must present to the Dean of the Faculty, as early as possible, satisfactory evidence showing them to be of good moral character and of appropriate elementary education, and so circumstanced as to *require* this assistance.

SPRING, OR PRELIMINARY COURSE.—The Faculty, with the view to in-

creasing the facilities for medical instruction, without additional cost to the student, will deliver annually a gratuitous preliminary course of lectures upon subjects of importance, commencing on the first of February, and continuing till the commencement of the regular course. Attendance upon this course is particularly desirable, inasmuch as the topics treated of will be such as it will be impossible to reach in the regular course, and hence will enable the Professors to treat exhaustively their respective subjects.

BOOKS OF REFERENCE.—Anatomy: Gray's Anatomy and Wilson's Anatomy.

Physiology: Dalton's Physiology, Draper's Human Physiology, Flint's Physiology.

Chemistry: Towne's Chemistry, by Bridges.

Materia Medica: Biddle's Materia Medica, Wood's Materia Medica, Still's Materia Medica, and United States Dispensatory.

Surgery: Erichsen's Science and Art of Surgery, Gross' System of Surgery, H. H. Smith's Operative Surgery.

Principles and Practice of Medicine: Flint's Practice of Medicine, Aitken's Practice of Medicine, and Bennett's Practice of Medicine.

Clinical Medicine: Tanner's Clinical Medicine, Da Costa's Medical Diagnosis, and Loomis' Physical Diagnosis.

Obstetrics and Diseases of Women and Children: Bedford's Principles and Practice of Obstetrics, Scanzoni's Diseases of Women, Thomas' Diseases of Women, Sim's Uterine Surgery, Simpson's Diseases of Women, and West on Diseases of Children.

Ophthalmology and Otology: Troelsch on the Ear, Wells' Treatise on Diseases of the Eye, and Donders on Refraction and Accommodation.

Medical Jurisprudence and Mental Diseases: Maudley's Physiology and Pathology of the Brain, Bucknell and Tuke on Insanity, and Taylor's Medical Jurisprudence.

Hygiene: Park's Manual of Practical Hygiene, Hammond's Treatise on Hygiene, Mapother's Lectures on Public Health, and Huxley and Youman's Physiology and Hygiene.

In the matter of the application of certain ladies for admission as students in the Medical College, the Regents, after a due consideration of the matter, decided that students should be admitted without regard to sex, as in the other Colleges of the University.

ORIENTAL COLLEGE.

By the terms of a gift of Mr. Tompkins, the Regents have come under obligations to establish and maintain a Professorship of Oriental Languages, especially of Chinese and Japanese.

At the opening of Congress in December, eighteen hundred and seventy-three, President Grant recommended that the Japanese Indemnity Fund be devoted to educational purposes. Subsequently, the following bill was brought before the United States Senate, by Hon. A. A. Sargent, and referred to the Committee on Foreign Relations. Its purport is, to bestow annually the income which shall be derived from the "Japanese Indemnity Fund" upon a Board of seven Trustees. These Trustees are to maintain, in connection with the University of California, "an Oriental College," which will have three objects: First—To promote international acquaintance and good will, by assembling a body

of learned teachers who shall inquire into and make known the languages, laws, religions, and political institutions of the Orient. Second—To afford young Americans an opportunity to fit themselves for diplomatic, consular, mercantile, and scientific careers in Asia. And third—To give to young Japanese an opportunity to become acquainted with the civilization of the western nations.

"A BILL MAKING PROVISION FOR AN ORIENTAL COLLEGE.—*Be it enacted, etc.*, That the Secretary of the Treasury is hereby authorized and directed to invest the proceeds of the Indemnity Fund paid by the Government of Japan to the Government of the United States, under the Convention of Simonoseki of October twenty-two, eighteen hundred and sixty-four, now remaining in the Treasury, in five per centum gold-bearing bonds of the United States, and to annually pay the income thereof to seven Trustees, to be appointed by the President of the United States, for the uses hereinafter mentioned.

"SECTION 2. That the President of the United States shall appoint, by and with the advice and consent of the Senate, a Board of seven Trustees, to serve without pay, and from time to time, as vacancies occur in said Board, shall fill such vacancies; which said Trustees shall maintain, in connection with the University of California, and with such other institutions of learning as may seem likely to promote the purposes of this endowment, an Oriental College, the object of which shall be to promote a knowledge of the languages, history, religions, laws, manners, resources, and commercial relations of Asiatic countries for the sake of increasing international friendship and intercourse; and also to afford American youths an opportunity to fit themselves for residence and service in the Orient, as diplomatic or consular agents and interpreters, or for private careers; and also to afford Japanese youths an opportunity to pursue their education in this country under favorable circumstances.

"SEC. 3. That said Trustees shall annually, upon meeting of Congress, report to the President of the United States the financial and educational condition of their trust."

CALIFORNIA COLLEGE OF PHARMACY.

In accordance with the organic Act of the University of California, the California College of Pharmacy is hereby affiliated with the University, upon the following basis:

The College will maintain its own Board of Trustees, and will continue to hold its own property as if this affiliation had not been agreed upon.

The College will also appoint its own professors, and establish its own course of instruction, subject to the general approbation of the Regents of the University.

The University will confer the degree of Graduate in Pharmacy upon candidates recommended by the Board of Examiners of the College, and approved by a committee to be designated by the Regents.

This agreement may be canceled by mutual consent, at any time, or

by the withdrawal of either party to it, after twelve months' notice to the other party.

The California College of Pharmacy has entered on the third year of its existence.

The reports of the officers show that the institution is in a very satisfactory condition.

The class of eighteen hundred and seventy-four consisted of twenty-three students. The attendance was good, and the interest manifested was creditable to the students, as well as gratifying to the professors.

As yet, no rule for a preliminary examination (before matriculation) has been adopted by the College, but as the time is not distant when pharmaceutical examinations will be the rule, the Trustees urge on Pharmacists the desirability of taking for apprentices such youth only as have had the advantage of a liberal education. If a knowledge of the elements of Latin has not been acquired, the candidate should lose no time in making himself sufficiently familiar with that language to enable him to read prescriptions and pharmacopœias.

And the Trustees further wish it to be made known that the students cannot reach the full benefit of the lectures, nor acquit themselves creditably at the examinations of this College, without such necessary education.

Legislative enactments relating to Pharmacy have been in force for several years in the Cities of New York, Philadelphia, Baltimore, Boston, St. Louis, and San Francisco, which compel all persons commencing business to show that they are properly qualified.

The College is now permanently located in Toland Hall, a fine building belonging to the University of California. The accommodations, consisting of Lecture-room, Laboratory, Library, and Museum, are abundant for our present wants, and well adapted to the purposes of the College.

The plan of instruction for the coming session will embrace the branches of Chemistry, Pharmacy, Botany, and Materia Medica. It is the design of the Trustees to furnish such a course as will give the students a knowledge of the general principles of the sciences taught, and show their special and practical application to pharmaceutical requirements.

LECTURE TERM.—The regular term for eighteen hundred and seventy-five commenced on Tuesday, March tenth, and will terminate in September. In order that students may derive full benefit from the lectures, they should be present at the opening of the session.

The lectures are given on Tuesday and Friday evenings of each week, at Toland Hall, Stockton street, between Chestnut and Francisco streets.

PHARMACY.—The lectures will be delivered on Tuesday of each week, at seven o'clock and thirty minutes P. M.

The principal subjects are as follows: Weights and measures of the United States and British Pharmacopœias and the metrical system. Specific gravity, thermometers, drug powdering, sifting, solution, filtration, maceration, percolation, re-percolation, evaporation, distillation.

The Galenical and Chemical preparations of the United States Pharmacopœia. Extemporaneous pharmacy, including construction of formulas, the art of combining medicinal agents, pills, mixtures, ointments, suppositories, plasters, etc.

CHEMISTRY.—The lectures will be delivered on Friday of each week, at seven o'clock and thirty minutes P. M.

This course will present a systematic study of theoretical chemistry, according to the latest views of chemical philosophers.

Physics will be dwelt upon sufficiently for the illustration of the general properties of matter—the forces of gravitation, adhesion, and cohesion.

Caloric in its relation to chemistry will be treated of.

This will be followed by the laws of chemical affinity, the electro-chemical theory, symbols, nomenclature, and the laws of chemical combination. The molecular theory and the principles of crystallography will be fully illustrated, the former by graphic symbols and diagrams, the latter by models.

A full and concise course of the chemistry of the non-metallic and metallic bodies is next taken up, comprising the more important elements, and those of special interest to the pharmacal student.

The course to conclude with organic chemistry, in which the chemistry of the alcohols, ethers, organic acids, sugars, glucose, gums, starch, glucosides, alkaloids, etc., will receive their due share of attention.

MATERIA MEDICA.—The lectures will be delivered on Tuesday of each week, at eight o'clock and thirty minutes P. M.

The lectures on Materia Medica are devoted to those substances, chiefly of vegetable origin, which are used in medicine, and which are included under the general designation of *drugs*.

These articles are treated of in a systematic manner, notice being taken of the sources from which they are derived, their natural and commercial history, principal constituents, and remedial qualities. The ordinary and toxical doses, with antidotes to the latter, receive careful consideration.

The students are instructed as to the proper time for collecting the various vegetable products, as well as the best modes of preserving them. Attention is called to their physical properties as met with in trade, and to the leading characteristics of each drug. Substitutions, adulterations, and natural impurities, with the methods of detecting the same, are duly considered, as also the distinguishing features observed in articles of superior and inferior quality.

BOTANY.—Friday evening of each week, at eight o'clock and thirty minutes P. M., at Toland Hall, and on Monday of each week, at one o'clock P. M., at the hall of Academy of Sciences. The lectures include structural, functional, and systematic botany, and geography of plants. Excursions are made into the country on alternate weeks during the session, for the purpose of collecting and studying indigenous plants, under the direction of the professor.

CONDITIONS OF GRADUATION.—1. The candidate must be of good moral character, and have attained the age of twenty-one years.

2. He must have attended two full courses of the lectures given by this College, or one of those given by some other College of Pharmacy whose conditions of graduation are based upon the like term of service, and the final course in this College.

3. Written evidence of the four years service required by the Constitution, must be deposited with the Secretary of the College, upon applying for examination.

4. He shall at the same time deposit with the same officer, an original dissertation upon some article of the Materia Medica, some Pharmaceutical Process, or the details of an analysis of some chemical substance

which must have been performed by himself. This manuscript must be in his own handwriting, and be executed in a neat and legible manner.

5. He must be recommended jointly by the professors and the Examining Board.
6. Such recommendation must be approved by the Board of Trustees.
7. Examinations shall only take place at the close of each course.

FEES.—Lecture ticket (for the season), fifty dollars.

Matriculation ticket (paid only once), two dollars and fifty cents.

Diploma fee, ten dollars.

The matriculation and lecture tickets must be obtained of the Secretary at the beginning of the session.

Members and graduates of the College, and students who have attended two sessions in the College, are admitted free to the lectures.

Medical students, or others not intending to pursue pharmacy as their avocation, will be admitted to the lectures, or any one of the courses they may desire to attend, by paying the matriculation fee, and that of the chair or chairs of instruction; and such students will enjoy the same advantages as regular students of pharmacy, except that they will not be eligible to the degree of a graduate in pharmacy.

TEXT-BOOKS.—United States Dispensatory and United States Pharmacopœia; Pereira's Materia Medica, edited by H. C. Wood; Fownes' Chemistry; Attfield's Chemistry; Boscoe's Chemistry; Gray's Botany.

Young men coming to the city to attend lectures, should bear in mind that they cannot expect to receive much compensation whilst attending lectures and learning the business.

Any further information may be obtained by addressing

EMLEN PAINTER,

Secretary California College of Pharmacy, southeast corner Clay and Kearny streets, San Francisco.

GENERAL MATTERS—EDUCATIONAL, ETC.

THE LIBRARY.

The general reference library of the University is now placed on the main floor of the south hall. This is regarded as only a temporary arrangement, until a proper building is provided. The reason for the selection of this room was its accessibility, its light and cheerful character, and the fireproof construction of the building. The library is arranged by subjects, in alcoves and in cases, which are handsomely made, with reference to their removal in the right time to a new building. The library remains quite small, but is an excellent nucleus for a college library, especially in English and French books; there are but few in other languages. The nucleus of the library is derived from an appropriation, by the Regents, of five thousand dollars, made several years ago, and expended chiefly under the direction of the Library Committee. To this have been added numerous generous gifts from individuals, the most noteworthy of which are the following: a collection of Cyclopedias and other works of reference, from Mr. E. L. Goold, the literary and art books, with some scientific treatises, which belonged to the late F. L. A. Pioche, and which are for the most part very handsomely bound; the library of Dr. Francis Lieber, which was particularly full in works pertaining to political and social science, and included

many rare tracts and pamphlets, the gift of Michael Reese; and the professional library of the late Dr. Victor Fourgeaud, consisting of several hundred volumes, well bound, of medical works in French and English. The Legislature of the State, in eighteen hundred and seventy-three, made a special appropriation of four thousand eight hundred dollars for the increase of the library, and with this sum large accessions are about to be made. The number of volumes is about twelve thousand, more than double what it was in eighteen hundred and seventy-two.

It is intended that the main library of the University shall be chiefly a reference library, so that scholars in any department may be sure of finding upon the shelves the various treatises which they wish to consult; consequently, permission to draw books from this library is given only in exceptional cases. But in building up the reference library, it is necessary to keep in mind, also, the need of supplying the students with books which they can take to their rooms with freedom; consequently, a branch circulating library has been begun in the north hall. This circulating library is made up in part from the duplicate books belonging to the main library, and in part from the gifts of individuals, among whom the members of the senior class of eighteen hundred and seventy-five are particularly entitled to recognition. Two other branch libraries have also been begun. The best and most important books pertaining to the science of agriculture have been transferred to the lecture room of the Professor of Agriculture, and some of those pertaining to the useful arts will be in a like manner made accessible to professors and teachers in the rooms devoted to instruction in mechanics. The gift of Mr. Pioche, and the gifts of other individuals, have made it possible to begin also a group of books relating particularly to the fine arts. In due time it is hoped that every one of the chief rooms of instruction will be furnished with the books which pertain to the studies there pursued. Thus the rooms devoted to modern languages should be supplied with the best dictionaries, grammars, and standard literary works. There should be a reference mathematical library within easy reach of the instructors of mathematics. And so in engineering, in chemistry, in historical and political subjects, the books most constantly needed by professors or students should be within easy reach. Thus the main library would be to the University a general storehouse; a place of resort for the professors and students when they wished to prosecute their studies; while the instruments needed for daily service would be kept within easy reach, in the ordinary places of study and instruction.

In speaking of the library, special attention should be called to the fact that a very large collection has been made of newspapers illustrative of the history of California. Among the extended sets which have been given by various individuals, the following are noteworthy: the *New York Times*, the *Sacramento Union*, the *San Francisco Chronicle*, first series, the *San Francisco Bulletin*, the *Alta California*, and the *Herald*.

The Regents have recently appointed Mr. J. C. Rowell, a graduate of the University of the class of eighteen hundred and seventy-four, as Librarian, and he is now in the East, inspecting the older libraries of the country and the methods of classification and arrangement pursued therein.

Under the appropriation made by the Legislature, at its last session, extensive purchases have been made—some have already been received and others are on the way. Many important gaps will be filled and the

educational value of the library to the students largely increased. A special purchase of some one hundred and thirty volumes relating to agriculture has been made, and many indispensable works on mechanical subjects have been purchased and will soon be placed on the shelves.

The care of the library has been divided heretofore between Professor Sill and Instructor Gompertz, who have given it much time and attention. They have been assisted in some of the minor work by students, who have been paid by the hour for their services. A great deal has been done by Mr. Gompertz, at intervals between his class duties, and the rough list shows the number of titles entered by him during the year, in the numerical and authors' catalogue, to be three thousand three hundred. In the course of a few months the catalogue of the library will be completed.

BRANCH LIBRARIES.

Circulating.—Two hundred and seventy duplicates have been donated from the main library, to form a nucleus for this branch; and to which the students and others are contributing in such a manner that it promises shortly to become quite a respectable collection.

Besides the above, there is a small library under the charge of the Professor of Mechanics and Mechanical Drawing, consisting of books relating to these subjects.

Attendance.—The daily average attendance of the students in the library, is ninety-seven; and the average number present at any one time through the day is thirteen.

DONATIONS TO THE LIBRARY OF THE UNIVERSITY OF CALIFORNIA.

[Received from June 1st, 1873, to July 1st, 1875.]

From William Sharon, sets of the San Francisco *Bulletin*, the Sacramento *Union*, and the San Francisco *Herald;* also *Evening Picayune* for eighteen hundred and fifty-one.

From James Anthony, a set (nine volumes) of the early series of the San Francisco *Chronicle.*

From Judge S. J. Field, one hundred valuable volumes.

From proprietors of the *Bulletin* and the *Union*, a kindly promise to continue the series of their papers.

From C. H. Hawks, Esq., of New York, the Colonial Records of Massachusetts and Plymouth, in sixteen quarto volumes (a costly and valuable set).

From Messrs. James Anthony & Co., the forty-fifth volume of the Sacramento *Union.*

From President Gilman, two hundred and fifty volumes of scientific and literary works.

From Professor William Ashburner, a set of The Annales des Mines, seventy-six volumes, 8vo., well bound, a costly and valuable series; also a copy of the new Geological Map of the United States, by Hitchcock & Blake.

From George F. Allardt, Esq., C. E., a mounted copy of his new map of Alameda County.

From Mr. Alexander Agassiz, copies of all the works of his father, Professor Louis Agassiz, not before owned by the University.

From Professor Simon Newcomb, of the United States Naval Observatory, a letter designating the Library of the University to be the ultimate recipient of a full series of the Greenwich Observations, conducted by the Astronomer Royal. This extensive and costly series is now in the possession of Professor Newcomb.

From the widow and daughter of the late Dr. V. T. Fourgeaud, of San Francisco, the professional library of the late Dr. Fourgeaud; believing that they "could make no disposition of these books which would have been more gratifying to their lamented owner."

MUSEUM.

The collections belonging to the University, though still incomplete, are, in many departments, both large and valuable. They consist of five distinct parts, viz: the *State Geological Survey Collection*, the *Mills Collection*, the *Pioche Collection*, the *Keene Collection*, and the *Ward Series of Casts.* In organic forms the Museum is particularly deficient.

1. The Geological Survey Collection has been removed to Berkeley, and will be exhibited as soon as the museum cases are ready for its reception. Professor J. D. Whitney, the State Geologist, has furnished the following account of it:

The State Geological collection comprises:

(*a*) A full collection of rock specimens from all parts of the State.

(*b*) A large number of specimens, illustrating the mining resources of California.

(*c*) Specimens of minerals occurring in the State.

(*d*) A large and full collection of the fossils of California, both animal and vegetable. These have already been described, and figured in the Geological Report, with the exception of the fossil plants, which are now undergoing investigation at the hands of Mr. Lesquereux, and whose results are nearly ready for publication. There are in the State collection as follows: of Cretaceous species, two hundred and thirty-one; of Tertiary, one hundred and forty-eight; of living species, found fossils, one hundred and thirty-two; besides all that have been obtained from the older formations. There are also great numbers of duplicate specimens, valuable for exchange and for use in teaching.

(*e*) The Natural History collections, comprising forty-two species of mammals, two hundred and twenty-eight of birds, forty-five of reptiles, eighty-seven of fishes, and six hundred and fifty-two of mollusca.

Also, a large and full suite of Botanical specimens, which can be named authentically as soon as the volume of Botany of the Geological Report is ready.

A valuable portion of the Natural History collections was lost by the burning of the steamer "Golden Gate," while on the way to the Smithsonian Institution to be examined and described.

A superb collection of the ores of California, comprised in fifty-nine large boxes, and made during the earlier years of the survey, was lost by the burning of the "Pacific Warehouse," in San Francisco. Much time and labor was devoted to the formation of this collection, and its loss very seriously impaired the value of the Geological Survey material.

2. The cabinet collected through the indefatigable industry of Mr. C. D. Voy, and presented to the University through the munificence of Mr. D. O. Mills.

This collection has been accessible to the University for several years, and its value is well known. It consists of nearly eight thousand specimens of rock, minerals, ores, fossils, both animal and vegetable, human

antiquities, and some living shells, nearly all from California. It contains very fine specimens of ores and minerals, but is especially rich in fossils and in relics of the prehistoric races of California.

3. *The Pioche Collection.*—This is a large miscellaneous collection of minerals, ores, shells, and curiosities of many kinds, presented to the University by the late Mr. Pioche.

4. Selections from *Ward's Series of Casts.*—These casts are made from the most perfect specimens of fossils in the great museums of Europe and the United States. They are expressly intended and admirably adapted for teaching. For this purpose they are, in fact, almost indispensable, since the geological history of the earth is but imperfectly represented in California, and the originals of these great fossils cannot be obtained. The selection is by no means complete, but is as large as the limited means of the University at the time of purchase would allow.

5. A very choice collection of minerals, brought together by H. G. Hanks, Esq., of San Francisco, during many years of research, has been recently purchased for the University, and presented to it, by James R. Keene, Esq., of San Francisco.

MUSEUM OF ECONOMIC AND SYSTEMATIC BOTANY.

One of the rooms in the South Hall is intended for the illustration of Botany. Among the collections already received are a valuable herbarium of Australian plants, presented by Mr. Henry Edwards; a collection of native woods, cones, etc., presented by Mr. C. D. Voy; the beginning of a collection of cereals, for which large additions are promised; photographs, presented by Mr. Watkins, of the characteristic trees of California, etc.

MUSEUM OF ETHNOLOGY.

An excellent beginning has been made of a collection to illustrate the characteristics of primitive men. In the museum bought from Mr. Voy were many remarkable stone implements and skulls from the Pacific Coast; and in the gift of Mr. Pioche were many wooden and other implements from the Pacific Islands. Dr. W. Newcomb has given a very interesting collection of Peruvian pottery.

MUSEUM OF CLASSICAL ARCHÆOLOGY.

The University is in possession of a small cabinet of coins and medals. There are over four hundred ancient coins, mostly Roman; about three hundred and fifty medals, and over three hundred modern coins, illustrative of many nations.

Through the liberality of Mr. Charles Webb Howard, sets of ancient wall maps have been placed in the classical rooms, as also many photographs and other pictures illustrative of ancient life, customs, and architecture. These include the Langl and Launitz sets, Ducher's photographs, Stillman's views of the Athenian Acropolis, Rheinhard's Classical Album, etc.

Other illustrative works are much to be desired, especially casts and models representing ancient works of art.

FURTHER CONTRIBUTIONS.

Further contributions to the Museum are earnestly solicited. Messrs. Wells, Fargo & Co. generously offer to transport such gifts to the University gratuitously. The University will be especially glad to receive such specimens as these:

1. Minerals, ores, fossils, and metallurgical products.
2. Specimens of the native plants, of the woods, timber, and peculiar vegetation of any region.
3. Specimens of rare insects, fishes, shells, birds, and animals.
4. Indian antiquities, skulls, weapons, stone implements, dresses, and other illustrations of aboriginal life.
5. Books, pamphlets, photographs, and maps.

Full directions will be given to any one interested in making collections, and every object received will be gratefully acknowledged to the donor, if the source of the gift is known, and will be accordingly entered on the University records. Specimens should be distinctly labeled, especially as to *the place* from which they were originally taken.

Mr. Valentine, General Superintendent, gives these directions to the agents of the company:

"Whenever any article is obtained, pack it securely, and address: 'University of California, Berkeley (Oakland), California,' waybilling it by express to Oakland, *free,* inclosing, by letter to the University, any information relating to the thing sent."

GENERAL REMARKS.

The Museum is at present in the South Hall, where it will have to remain until a suitable building is provided to receive it. It forms not only an attractive feature to the visitor, but is of the greatest importance in connection with the educational department. It enables the professors and instructors to present to the eye of the student the very objects upon which they are lecturing. The valuable material pertaining to this department is now being arranged as rapidly as the means at the disposal of the Regents will permit. The collection has already assumed such proportions as to require, if properly classified and arranged, a building nearly as large as the South Hall.

As a Museum of mechanical objects has been started in connection with the College of Mechanics, more space than is now available is imperatively required.

DONATIONS TO THE MUSEUM.

[Received from December 2d, 1873, to July 1st, 1875.]

From James R. Keene, Esq., of San Francisco—the Hanks' collection of minerals.

From Professor Allen, of Cornell University—a medal, very rare and possibly unique, struck in commemoration of George Berkeley. Upon one side is the line of Pope—

"To Berkeley every virtue under Heaven,"

and the words "St. Paul's College, Bermuda, incorporated A. D. 1726." Upon the reverse, "'God hath made all men of one blood,' Acts xxii, 26."

From Mr. C. D. Voy, of Oakland—an extensive and beautiful collection of the native woods of California, together with a collection of cones and seeds.

From Dr. W. Newcomb, of Oakland—a number of specimens of ancient Peruvian pottery.

From James Scrimgeour, Esq.—a collection of the ores, vein, and country rock from the "Emma Mine," Little Cottonwood Cañon, Utah.

From Stephen Powers, of Sheridan, Placer County—five photographic likenesses of California Indians.

From Samro Takaki, Esq., Japanese Consul—a series of copper, silver, and gold coins, lately struck for the Japanese Government.

From Hon. John W. Dwinelle—a collection of one hundred and sixteen specimens of the woods of Java, each specimen neatly cut out in the form of a book, and appropriately labeled and indexed; also, seven casts in plaster, taken from the heads of historical characters: namely, Henry IV; Charles I; Oliver Cromwell; Isaac Newton; Mirabeau; Robespierre, and Napoleon I.

From A. L. Bancroft, Esq., of San Francisco—a large collection of specimens of Roman building stones, marbles, etc., in a suitable case. Also, skull of porpoise from Nathan C. Carnall; and several smaller gifts with which no names were sent.

OTHER DONATIONS.

From Dr. C. L. Anderson, of Santa Cruz—a collection of several species of willows.

From Dr. A. Kellogg, Regent Bolander, W. J. Fisher, Mrs. Leland Stanford, and S. Nolan—seeds and plants for the agricultural department.

From W. T. Garratt, Esq., of San Francisco—a collection of fifty-eight pieces of castings in brass, particularly valuable for use in the College of Mechanics.

From Mr. L. M. Rutherford, of New York—a series of photographic views of the different phases of the moon as seen through his telescope.

SPECIAL APPROPRIATION FOR EDUCATIONAL AND MECHANICAL PURPOSES.

The appropriation made by the Legislature of the State, at its last session, by the terms thereof, specified that fifteen thousand dollars should be expended for agricultural and mechanical improvements and purposes. This has enabled the Regents to expand the mechanical instruction given in the University, as well as to proceed vigorously with out-of-door agricultural operations.

A Chair of Industrial Mechanics was instituted in the Autumn of eighteen hundred and seventy-four, and was subsequently filled by the appointment of Mr. Frederick G. Hesse, of Oakland. Mr. Hesse was trained in a German polytechnic school, and was early engaged as a teacher in Brown University. He subsequently held a scientific appointment under the United States Government, but has resided for the last few years in Oakland, engaged in mechanical occupations, especially in the invention and improvement of some ingenious mechanical contrivances. It is rare to find a man qualified to fill the duties of a Chair of Industrial Mechanics, both by his scientific attainments and by practical knowledge acquired in the shop. Upon assuming the duties of his post, he delivered a lecture on the Profession of Mechanical Engineering, which has been printed. He is now engaged in devising implements by which a thorough examination may be made of the strength of the timbers of the Pacific Coast, to which reference has been made on another page in this report. (1)

Mr. John D. Hoffmann was appointed, in the Autumn of eighteen hundred and seventy-four, Instructor of Industrial Drawing. He is an experienced engineer and draughtsman, who was trained in Germany, has had long experience in the construction of public works, especially in the service of the United States Government, and he is in all respects qualified to impart an exact knowledge of this most important art.

The printing office has been enlarged, as will be seen under the head of "Manual Labor," and a purchase made of the famous and excellent Auzoux mechanical models for the College of Mechanics. In connection with this department, attention is also called to the lectures referred to before.

As will be seen upon turning to that portion of this report which relates to the College of Agriculture, active operations have been diligently carried on, and several farm and work buildings constructed; the agricultural grounds graded in part, plowed, and generally improved; a large standard orchard planted, and great numbers of trees and plants, useful and ornamental, have been produced. In addition to the regular instruction, as will be seen elsewhere, lectures have been delivered upon subjects related to agriculture, and every effort has been made to create an interest in the minds of the students pursuing studies, special or otherwise, in these directions.

FURTHER EDUCATIONAL APPOINTMENTS.

In addition to the appointments of Professors Hesse and Hoffmann, in the College of Mechanics, the Chair of Mining has been filled by the appointment of Mr. William Ashburner, mining engineer, of San Francisco, who will direct his attention to the organization of the College of Mines, as fast as the funds are provided for this purpose. Mr. Ashburner, having received a technical and scientific education in the East and in Europe, came early to the Pacific Coast, and was for a time engaged upon the Geological Survey of California. He has had ample opportunities for becoming acquainted with the mining industries of this and other countries, and he has already made his influence felt for good upon the students of this University. Dr. George F. Becker, a graduate of the Royal School of Mines, has also been appointed Instructor in Metallurgy.

The Chair of Agriculture has been filled by the appointment of Professor Eugene W. Hilgard, Ph. D., formerly of the College of Agriculture and Mechanic Arts, in the University of the Mississippi, and recently of the University of Michigan. While in Mississippi he had charge of the Geological and Agricultural Survey of the State. Mr. Hilgard's eminence as a man of science, his skill in applying his knowledge to agriculture and other industrial pursuits, and his long experience as a teacher, have qualified him in an uncommon degree to discharge with satisfaction the difficult duties devolved upon him. He is well

(1) See College of Mechanics, ante.

known for the attention which he has given to the analysis of soils, and for the light he has thus thrown upon some of the most intricate problems in agricultural science.

The Professorship of English was filled by the appointment of Mr. Edward R. Sill, a graduate of Yale College, who has been engaged in teaching in California for several years, and is highly esteemed for his literary attainments, for his enthusiasm in the study of language, and for his devotion to the work of a teacher.

The vacancy occasioned by the withdrawal of Professor Jones was filled by the appointment of two graduates of the University to be assistants in mathematics—Mr. George C. Edwards and Mr. Leander L. Hawkins—and they have, during the last two years, discharged this service with great fidelity. Mr. Edwards has had the command of the battalion in addition to his duties as mathematical instructor, and Mr. Hawkins has had the chief direction of the classes in surveying.

Mr. Albin Putzker entered upon his duties as special instructor in German, in the Spring of eighteen hundred and seventy-four, and has succeeded, in a remarkable degree, in awakening a love of the study of that language among all classes of students. He was previously head of the Santa Barbara College.

Mr. H. B. Jones has recently been appointed assistant instructor in German.

The large number of scholars pursuing the study of French, under Professor Pioda, made it indispensable to provide an additional instructor in that department, and Mr. G. de Kersaint-Gily has accordingly been appointed. The place occupied by Mr. Correlia, as instructor of Spanish, has been filled by the appointment of Mr. Charles D. Gompertz.

Mr. Arthur H. Allen, graduate of Yale College, who was employed for a single year as instructor in the College of Letters, discharged these duties with skill and success until he was released from service at his own request. The place he had held was filled by the appointment of A. C. Richardson, a graduate of Harvard College, distinguished for his knowledge of the classics, who still continues to give instruction.

GRADUATE ASSISTANTS EMPLOYED.

The Board has recently reaffirmed its policy of employing student assistants, and have made several appointments and reappointments for the next academic year; and, by formal vote, authorized the Advisory Committee to renew engagements and fill vacancies in pursuance of said policy.

ENCOURAGEMENT TO GRADUATES TO STUDY ELSEWHERE, ETC.

The Board has also expressed its approval of the policy of encouraging graduates of the University to prosecute advanced studies, both in the University of California and in other Universities, and granted leave of absence, for one year to two, of the post-graduates who were acting as assistants in the College of Chemistry, to enable them to pursue special study in Germany, without pay during the term of absence, but assuring them of position and an advanced salary upon resumption of service.

At the last meeting (May sixth) the Advisory Committee reported the following graduates as having been appointed on the Educational Staff for the next year:

J. C. Rowell..Librarian.
E. A. Parker..Assistant Instructor in Physics.
Isaac T. Hinton...........................Assistant Instructor in Mathematics.
(In place of T. F. Barry, resigned.)
J. W. Bice..Student Assistant in Surveying, etc.
Frank S. Sutton...Assistant in College of Agriculture.
W. Carey Jones..Recorder to the Faculty.

And F. Slate, Jr., S. B. Christy, and W. R. Barbour, in the College of Chemistry.

Also, the following student-assistants: F. P. McLean, F. L. Button, and J. B. Clarke.

MANUAL LABOR AND PECUNIARY ASSISTANCE.

One of the best characteristics of the American colleges is the bringing together on terms of equality, free from artificial and conventional distinctions, young men of different pecuniary conditions. The sons of the rich and of the needy grow up side by side, and the honors which they receive from one another and from the Faculty are bestowed without any reference to the homes from which they come. Thus year after year many of the highest distinctions are bestowed upon those whose struggles for an education have been carried on in the face of extreme poverty and sometimes of other great embarrassments. In the University of California, as in other kindred institutions, the honors of literary and scientific distinction are thus bestowed upon the most meritorious, without any reference to their antecedent training. It is a great advantage of a system of public education, particularly in this country, that it brings together on terms of complete scholastic equality those whose material circumstances differ so widely. Almost every college of the country has found it expedient in some way or other to provide suitable encouragement to young persons while pursuing their courses of study. During four years of the history of the University of California, there were five scholarships, the incumbents of which received each an income of three hundred dollars per year, from the beginning to the end of their course, and some of the most meritorious scholars here graduated, owe their education to this timely assistance; but the change in the law, effected by the Political Code, abolished these scholarships, and no such aid is now given.

The authorities of the University, however, have done all in their power to throw into the hands of those who wished it opportunities to earn money in various ways. Some students have given private instruction to other students who needed assistance in their studies; others have been employed on holidays and in vacations and in their leisure hours in rendering assistance in various manual occupations, both in work upon the grounds and elsewhere; some have taken care of the buildings, and some of the heating apparatus.

Another agency by which many have found it convenient to add to their income, has been employment in the printing office. The printing office was commenced soon after the University was removed to Berkeley, by the purchase of type and a press at a cost of one thousand three hundred and fifty dollars, which was given to the University by ex-Regent Dr. Samuel Merritt. Subsequently, the Regents appropriated the sum of two thousand five hundred dollars for the expansion of this office. It has been found an exceedingly convenient part of the appa-

ratus at Berkeley, and has been the means also of imparting to many of the students a knowledge of a useful art and of enabling many deserving persons to add considerably to their income. So far as possible, when students have desired work in connection with the farm and garden, they have been allowed the opportunity, and in this, as in all other cases, have been paid the usual wages for their labor. The ability to add to one's income by manual labor while pursuing a course of study varies very much with individuals. Some are able to do a great deal in this way without impairing their standing as scholars; but, as a general rule, the majority do not desire labor, and the larger number require all of their time for the mastery of their lessons.

The Secretary reports that he has disbursed to students since the first of June, eighteen hundred and seventy-four, in addition to the amount paid to the University Press for printing, as follows:

Labor on grounds, Agricultural Department, etc.	$2,107 10
Library and Museum	399 74
Surveying	78 00
Work on students' cottages	94 00
Equipment and repairs	33 00
Attention to steam heater	183 00
Secretary's office—Copying	20 00
Manager of Printing Office	290 00
	*$3,204 84

* This does not include the amount earned by students in the printing office, and paid to them by the manager.

According to the statement of the late manager, Mr. Jordan (student), on file in the office of the Secretary, as many as thirty students have received more or less instruction and pecuniary aid, and the office has earned about two hundred dollars per month.

The bills paid to the printing office for work done for the University up to the first of August, foot up six hundred and thirty-eight dollars and twenty-nine cents; but a much greater amount of work than this represents has been done, including the students' paper—"The Berkeleyan"—published monthly, and which is entirely independent of the Regents and Faculty, being wholly controlled by the students; and a considerable amount of job work for business houses friendly to the students.

Of the unexpended balance of the Building Fund, since the date of the last report, five hundred and fifty-five dollars and forty cents was paid to the students for grading around the buildings.

The total amount earned by students, in various ways, is nearly six thousand dollars.

LODGING HOUSES FOR STUDENTS.

Upon the removal of the University to Berkeley, the Regents at first determined to do nothing toward the establishment of lodging houses for the scholars, but to depend entirely upon private persons to supply the requisite homes. They caused advertisements to be inserted in the newspapers, and announcements to be otherwise publicly made to this

effect, but after months of delay it became evident that private individuals would do but little for the supply of homes. Efforts were made to form associations for the purpose of providing homes or halls in the neighborhood of the University; but these efforts have not yet succeeded.

The Regents were therefore compelled to construct a few houses upon their own grounds, and at their own expense, for the use of students, and employed the well known Mr. Farquharson to make a plan. The design submitted by him was approved, and, by the authority of the Regents, he advertised for proposals. As the parties who were the lowest bidders, under the first advertisement, declined to fulfill their bids and enter into contract, proposals were again solicited by advertisement, and several bids were received, and a contract made with the lowest bidder, to build eight cottages, according to the plan, for the sum of eighteen thousand dollars. This contract did not cover the furnishing of water-closets and bath tubs, or the laying of water-pipe, or the introduction of water into the houses.

This latter work was subsequently done, and separate buildings, conveniently arranged and located, were built, and water-pipe laid and connected with the main pipe and the houses.

The cost of the cottages, inclusive of the outbuildings, etc., is twenty-five thousand and thirty-nine dollars and thirty-nine cents. Of the foregoing amount, twenty thousand five hundred and thirty-nine dollars and ninety-four cents was borrowed of the Bank of California, for which the Regents gave their note, and the remainder, four thousand four hundred and ninety-nine dollars and forty-five cents, was paid out of current income.

Volunteer clubs were formed among the students to hire these cottages, at a rental of three hundred dollars per annum, or thirty dollars per month during the year of instruction. Each cottage contains five rooms, of large size (each designed to be occupied by two persons), a dining-room, a kitchen, and a servant's room; a bath-room, with other needed conveniences, was also constructed.

These cottages were rented by the University to the clubs, without any agency on the part of the Faculty. Good order was required from those who occupied them, but no attempt was made on the part of the authorities to control the internal management of any of these establishments. The relation between the University and the club was simply that of landlord and tenant, the landlord claiming the right to eject the tenant for any misdemeanor. It is too soon to tell how well this system will work. It was a temporary device in an emergency, and was based upon the experience of two clubs which had already found abodes in cottages at Berkeley.

Should sufficient accommodations be offered to students in buildings hereafter erected by private parties outside of the University grounds, these cottages, with slight modifications, could be all converted into residences for the professors, for which two are now used, six having been rented to students as soon as completed.

There is at the present time much apprehension in the minds of the Regents and Faculty of the University, arising from the question of lodgings for resident students. The few rooms in and about the University buildings which have heretofore been occupied by students, are now required for educational purposes, and the steady and large increase in the admissions each year, without any corresponding increase in dormitory accommodations, is already causing serious embarrassment.

Many applicants seeking admission, and who are competent to pass the examination, will be compelled to defer or abandon entering the University for this reason.

Judging from the number of applicants for the next term thus far, the Freshman Class is likely to number from one hundred to one hundred and twenty-five, which will make an increase of one hundred students over the last term.

If the matter of ordinary living conveniences for the students is a question of serious importance, so, also, is that of

RESIDENCES FOR THE PROFESSORS.

One of the greatest difficulties in the management of the University arises from the fact that so many of the professors and instructors are non-residents. The University should be surrounded by the homes of those who are engaged in the instruction of the youth; for as soon as a good neighborhood is formed, other families of culture and of influence may be expected to come to it, and all the attractions of a college village may be secured. But at present the neighborhood of Berkeley grows but slowly. There is in it no school, no practicing physician, and but few and indifferent stores. The walks and roads are in a bad condition most of the year, and the inconveniences of family life are great. Families hesitate to remove to Berkeley until they see that the professors and others who are most interested in the work which is there going forward have become residents of the University neighborhood. The law requires the Secretary to live at Berkeley, and he removed there soon after accepting the office. Three of the professors have built houses for themselves; two occupy cottages belonging to the University, paying rent for them. One has hired another cottage in the neighborhood; several of the younger instructors have been allowed to occupy small rooms in the public buildings, but this is all. It is of the first importance that measures should be taken to provide homes at Berkeley for all the permanent staff of instructors. Prior to the removal to Berkeley, the Regents had decided to construct a number of houses for the accommodation of the professors; the plans were drawn and the estimates received, but it appeared to some of the members that the Board had not the necessary authority to take this step, and accordingly the proposed action was reconsidered, and the plan abandoned.

GEOLOGICAL SURVEY.

By an Act of the Legislature approved March twenty-seventh, eighteen hundred and seventy-four, the material, equipments, etc., of the Geological survey were turned over to the University, as custodian or trustee. We received the material without an inventory. It has been stored at the University, so as to insure its preservation.

The specimens of all kinds are, by the Act creating the survey, the property of the University, and will soon be opened and properly arranged.

The legislative Act referred to appropriated five thousand dollars for the expenses incident to the performance of its requirements. Of said amount, demands to the amount of six hundred and forty-eight dollars and five cents, properly audited, have been paid by orders on the State Controller.

The Regents have learned that at the time of the suspension of the

Survey the State was indebted for various work to Mr. Julius Bien, lithographer in New York, as per bill rendered, five thousand three hundred and seventy-eight dollars and eighty-nine cents, currency. The lithographic stones, upon which are drawings representing years of field work, and embodying a great deal of critical scientific labor, as well as a large money cost, and which form portions of unfinished maps, are likely to be destroyed, unless the proper steps are taken to preserve them. Aside from this aspect of the question, the claim of Mr. Bien, as a matter of common honesty, must be considered, and if just, honorably paid, for the credit of the State.

The sale of the publications has been continued with Messrs. Payot, Upham & Co., in this city, and their statement hereunto appended shows a net result from sales from July ninth, eighteen hundred and seventy-four, to May first, eighteen hundred and seventy-five, of eighty-two dollars and sixty cents, which under the law must be paid into the hands of the State Treasurer, for the benefit of the School Fund.

In May, eighteen hundred and seventy-four, the Board accepted the proposition of Messrs. Hoffman & Craven to publish a new edition of the map of California and Nevada, they assuming all the liability, and returning forty cents a copy on each copy sold; this arrangement to continue for two years. From the statement of said firm, it appears that the number of maps thus far sold by them under this arrangement is two hundred and eighty, which, at forty cents each, makes the amount due the State one hundred and twelve dollars.

On the sixteenth of February, Professor Whitney sent a communication to the Board, requesting its sanction of the publication by him, at his own expense, of a resumé of the work of the Survey. The Board approved of the proposition, so far as they had any authority in the matter.

AGRICULTURAL OPERATIONS.

As so much has been presented relating to this department, under the heading of "College of Agriculture" and "Special Appropriations," etc., only a brief reference is necessary here.

Of the special appropriation for agricultural purposes, viz: fifteen thousand dollars for the two years, nearly the whole has already been expended; of said amount (1) six thousand two hundred and seventy-nine dollars and eighty-three cents is represented by the barn, propagating houses, horses, implements, and other equipment necessary for the prosecution of the work.

Of the amount expended for labor in this department, the greater

(1) Barn and propagating houses	$2,052 03
Tools, wagons, etc	1,755 94
Horses (one span)	400 00
Flower pots	586 50
Trees, plants, and seeds	925 72
Grain for horses, etc., manure and incidentals	559 64
	$6,279 83
Labor, including salary of gardener	7,950 15
	$14,229 98

part must be considered of permanent value; as it includes the grading of a part of the agricultural grounds, preparing a site for the nursery buildings, the deep plowing and subsoiling of nearly forty acres, the planting of the orchard and other trees, and the work in the propagating houses, for which latter we have to show several thousands of trees and plants in great variety, as before referred to.

The expenses of our agricultural operations are largely increased by our being compelled under the State law to receive eight hours as a day's work. No farmer could afford to employ labor in this way.

The yield of hay last season was sufficient to carry us through this to the next year, and this season's crop, about forty tons, will, therefore, be sold.

IMPROVEMENT OF THE GROUNDS, WATER SUPPLY, ETC.

As the income of the University has not permitted the grading of the grounds immediately around the building, or the making of roads, only some two thousand five hundred dollars has been expended during the two years covered by this report; about half of this amount has been paid out during the past twelve months, principally for the preliminary grading of roads where the same traversed the agricultural grounds, and which work was necessary to the furtherance of agricultural operations.

The construction of the roads through the grounds, the grading around the building, and last in order of reference, though really first in importance, the matter of an increased supply of water, by the building of an additional and larger reservoir, and the utilization of such springs as are not now available, together with a thorough reconstruction of and arrangement of the entire water-pipe system, at an expense of about twelve thousand dollars. Professor Soulé has made an elaborate report to the Regents upon the water question, having in view not only the present necessities of the institution, but also the probability that a large neighborhood will require to be supplied from the springs which the University controls.

BUILDING APPROPRIATION BY THE STATE.

On the eighteenth of June, eighteen hundred and seventy-four, the duties of the Regents, as directors and auditors of the expenditures under the State appropriation for the University buildings, practically closed; the last items of expenditure were approved that day. The records show that of the appropriation of three hundred thousand dollars, the segregated demands approved by the Board amount to two hundred and ninety-nine thousand nine hundred and twenty-six dollars and sixty-five cents; the balance, seventy-three dollars and thirty-five cents, has reverted to the State Treasury.

If to the foregoing is added the amount paid for the foundation and basement to the south hall, which was paid by the Regents directly, instead of by approved demands on the State Treasury, as above, the total shows as follows:

Demands paid as above by State Treasurer........................	$299,926 65
By Regents, as per trial balance, June 30th, 1875............	57,465 72
	$357,392 37

PROTECTION AGAINST FIRE.

In all of the halls in the University buildings, protection is secured against fire, so far as it is possible with the present capacity of the University Waterworks, by means of hose connecting with the service pipes; and a further provision has been made by the purchase of twelve dozen water buckets, which have been properly marked with the word "Fire," and placed in suitable boxes in the halls of the buildings. Two of these boxes, containing six buckets each, are in each hall in both buildings. These buckets are kept filled with water, ready for use in case of an emergency of this kind.

The University buildings, the students' cottages, the barn and printing office, all are insured, and a suitable safe has been placed in the Secretary's office for the preservation of the books and papers of his department.

FURTHER EDUCATIONAL BUILDINGS.

The increase in the number of students, as already presented in the previous pages of this report, and the ratio of increase as related to the immediate future, clearly indicate that an additional building is required for educational purposes. This is needed, not only for the reason of an *increased number of students* in the classes as heretofore, but the expansion of the University and consequent *increase in the number of classes*, necessitating additional class-rooms.

The Regents have been compelled to partition off the large room under the Assembly Hall in the north building, so as to make five rooms; also, to fit up the two rooms (though inconveniently small) in the boiler house, for Professor Becker's metallurgical instruction; and, in fact, to utilize all of the rooms in the various buildings, without regard to their fitness for the purposes for which they are required.

In the south hall, at present, five rooms are devoted and required for museum purposes, two for the library, and owing to the manner in which the building is partitioned, two also for the Secretary's office, making altogether nine rooms. This allotment of the rooms is of course a necessity, and the best that can be made at present; still, it is inadequate for the purposes to which the rooms are applied. The increase in the library and museum, and the suitable arrangement of both, is only partially possible, and that of the museum only to an exceedingly limited extent.

It is apparent, under the circumstances, that a building of a size not less than either of the present structures (and it would be wise to have it larger than either), for the reception of the library, museum, Secretary's office, etc., properly divided and suitably lighted for the purposes named, would place the nine rooms in the south hall at the disposition of the Faculty for class purposes, while the new building would, for some time to come, also accommodate several classes, until all of its rooms were required for its special purposes.

CALIFORNIA STATE NORMAL SCHOOL.

CALIFORNIA STATE NORMAL SCHOOL.

OFFICE OF THE BOARD OF TRUSTEES OF THE STATE NORMAL SCHOOL,
SAN JOSÉ, June 30th, 1875.

To His Excellency,
ROMUALDO PACHECO,
Governor of California:

SIR: In accordance with the requirements of the Political Code, we have the honor to submit to your Excellency the annual report of the Board of Trustees of the school, for the year beginning July first, eighteen hundred and seventy-four, and ending June thirtieth, eighteen hundred and seventy-five.

Very respectfully, your obedient servants,

C. T. RYLAND,
Vice President.

CHAS. H. ALLEN,
Secretary of the Board.

REPORT.

BUILDING.

The appropriation for the completion of the building has been expended by the Building Commissioners, and will by them be reported to your Excellency.

The first floor has been nearly finished, and the second floor so far completed as to fit it for occupancy. The growth of the school has rendered it necessary to furnish and use the building, so far as it is rendered fit for use, and we are now occupying all suitable space as class-rooms, dressing-rooms, or study-rooms.

The Building Commissioners declining to furnish any part of the building, we have been compelled to draw largely from the Current Expense Fund for this purpose. It is exceedingly desirable that the remaining part of the building be finished and furnished at an early day, as it will all be needed to meet the wants of the school within one year.

FINANCIAL STATEMENT.

We entered upon the year with the following funds:

Balance from the twenty-fifth fiscal year	$4 64
General appropriation for the twenty-sixth fiscal year	17,500 00
Tuition from City of San José	1,380 00
Received from City of San José (five months)	1,068 75
Tuition received from Preparatory Department	753 90
Tuition received from Training School	981 00
Amount received from sale of old seats	215 00
Total	$21,903 29

This has been disbursed as follows:

Salaries of Teachers (eleven months)	$14,757 50
Insurance	625 00
Fuel	454 70
Stationery and books (not Library)	667 58
Water (San José Water Company)	150 00
Advertisement "California Teacher"	100 00
Sundries	792 70
Commencement expenses	59 64
Exchange and discount	3 27
Furniture for school-rooms	2,730 77
Gas fixtures	550 00
Stoves	244 15
Library cases	499 87
Carpet	190 40
Watchman (old bill)	100 00
Total	$21,925 58

This leaves a deficit in the twenty-sixth fiscal year of one month's salaries	$1,245 00
Balance, as above	22 29
Total	$1,267 29

—To be paid from the coming fiscal year.

Of the above expenditures, the following are for *permanent* improvements, and are not to be chargeable to current expenses:

Furniture	$2,730 77
Stoves	244 55
Library cases	499 87
Gas fixtures	550 00
Carpet	190 00
Total	$4,215 19

The expenditures, however, becoming necessary by the growth of the school, we have not hesitated to furnish the entire second floor, and to draw from this fund, feeling sure that the full amount would be refunded from a special appropriation. The item of sundries in the above bill is largely for cases for apparatus, blackboards, furniture for dressing rooms, cleaning building after being vacated by the workmen, and moving and setting up desks, etc.

There is remaining a balance in the State Treasury of two hundred dollars and sixty-four cents, to be carried to the next fiscal year, but the tuition account is overdrawn to make the deficit.

The amount appropriated for the twenty-sixth and twenty-seventh fiscal years, viz: thirty-five thousand dollars, was based upon a prospective attendance of one hundred and fifty pupils. As will be seen by the report of the Principal of the school, the average attendance has been two hundred and thirty-four. Deducting from this number thirty-four, the average in the Preparatory Department (from whom a tuition fee has been required), and the school has averaged fifty more than the outside number provided for in the appropriation. By the most rigid economy, we have, notwithstanding the extra expenditures, kept the expenses so low as to create a deficit of only one thousand two hundred and sixty-seven dollars and twenty-nine cents. It must be borne in mind that two thousand four hundred and forty-eight dollars and seventy-five cents of the amount expended had already accrued from tuitions from the training school and preparatory school.

The school for the coming year will doubtless number more than three hundred, or double the number provided for. To meet the increased demand for instruction, we must increase the corps of teachers, and unwillingly, on our part, create a still greater deficit. The only alternative is to refuse admission to the school (which, if pupils are qualified, we have no right under the law to do), or to close the school for a part of the year. We feel assured that we have taken the better course, and that the coming Legislature will cheerfully appropriate a sufficient amount to meet this deficit, when the circumstances under which it has arisen shall be understood.

APPARATUS AND LIBRARY APPROPRIATION.

The appropriation of three thousand dollars for apparatus, and of five hundred dollars annually for library, are being expended with great care, purchasing only those articles which will be of constant use.

We felt warranted in expending five hundred dollars of the apparatus appropriation in the purchase of a very valuable collection of shells,

consisting of nearly three thousand species, collected and named by the late Dr. Canfield, of Monterey, to be named the "Canfield Collection." As we have been without means to provide cases for this cabinet, it is now lying in boxes, and of but little use. A small appropriation is needed to fit up cases and drawers for this collection.

We ask, also, that the annual appropriation for the library be continued, and that the sum of five hundred dollars annually be appropriated for additions to the cabinet and apparatus.

PREPARATORY AND TRAINING DEPARTMENTS.

The fact that many pupils come to the school, from abroad, holding certificates, and therefore entitled to admission, who are not qualified to enter the regular Junior Classes, has seemed to render it necessary to continue the Preparatory Class. This class has numbered nearly forty, most of whom are earnestly striving to fit themselves for the work of teaching.

The Training School required by law has been continued in two departments, a primary and an intermediate class, and a teacher put in charge of each. In these classes the pupil-teachers, by observation and practice, are greatly aided in acquiring the necessary skill in the art of teaching.

As will be seen, these departments are nearly or quite self-sustaining, a very unusual thing in a normal school.

SCHOLASTIC WORK.

For the organization of the Faculty, and a more detailed statement of the internal working of the school, we beg leave to refer your Excellency to the Catalogue for the year eighteen hundred and seventy-four-five, and more particularly to the report of the Principal, all herewith submitted.

From this it will be seen that yet more teachers are needed, which, we doubt not, a wise legislation will enable us to supply.

The school is now fully organized and fairly equipped, in a building of our own, large enough to furnish accommodations for all legitimate school exercises. The last annual commencement was held within our own building, with better accommodations than could be found elsewhere in the city. We look forward to a course of continued prosperity and usefulness for the California State Normal School.

REQUIREMENTS FOR TWENTY-EIGHTH AND TWENTY-NINTH FISCAL YEARS.

In conclusion, we beg leave to call attention to the following estimates of the amount required to carry the school through the twenty-eighth and twenty-ninth fiscal years, and we assure your Excellency that these have been carefully made, and do not exceed, by one dollar, the amount needed to conduct the school creditably.

For teachers' salaries, and other current expenses	$40,000 00
For library, $500 annually, or	1,000 00
For apparatus, $500 annually, or	1,000 00
Total	$42,000 00

A special appropriation, to meet the deficit of the twenty-sixth and twenty-seventh fiscal years, will be required. This deficit, as will be seen, is less than the sum expended by us for permanent improvements, four thousand dollars; also, to provide cases necessary for the preservation of the cabinet of shells and prepared specimens, seven hundred and fifty dollars; and for additional furniture, two hundred and fifty dollars; making a total special appropriation of five thousand dollars. Of the amount necessary to complete the building, and for the improvement of the grounds, we will not speak, as the vital wants are to provide for the school a competent corps of instructors, and to preserve what it has in its possession.

We feel confident that, when the work the school is doing is taken into consideration, the sum required will not be deemed unreasonable, and we indulge the hope that it will be provided without hesitation.

BOARD OF INSTRUCTION.

Charles H. Allen	Principal.
J. H. Braly, A. M	Vice Principal, pro tem.
Miss Eliza W. Houghton	Preceptress.
Miss Lucy M. Washburn	Assistant in Junior Class.
Miss Cornelia Walker	Assistant in Junior Class.
Miss Annie E. Chamberlain	Assistant in Junior Class.
Miss Mary J. Titus	Principal of Training School.
Miss Florence Grigsby	Assistant in Training School.
J. H. Elwood	Teacher of Vocal Music (part of the year).

CIRCULAR—1875-6.

The completion of another story of the building, including Normal Hall, has furnished plenty of convenient rooms for the accommodation of the school with its increased attendance. So rapidly have its numbers increased that additional teachers have been employed to meet the demand, and at least one more will be employed for the coming year.

Experience having demonstrated its necessity, the PREPARATORY DEPARTMENT will be continued, to afford an opportunity for those not fully qualified, to prepare for entrance into the Junior Class.

The Trustees have not had the means to provide for the PAST GRADUATE COURSE, chiefly owing to the large accessions to the other departments. If possible, this course will be opened during the second term of the coming year. It will be open to graduates of this or other Normal Schools, and to graduates of High Schools, Colleges, or Academies, who may pass the required examinations, and present satisfactory evidence of having taught successfully at least one year. The instruction in this course will, in the main, be professional, and to those graduating from it a professional diploma will be granted.

The PAST GRADUATE COURSE will afford an opportunity to teachers to review their studies, to become acquainted with the most approved methods of instruction, and by the aid of the apparatus with which the school is soon to be supplied, perhaps to become more familiar with illustrative apparatus, and more skillful in its manipulation.

The same efficient corps of instructors has been retained, and these, with the new members of the Faculty employed and to be employed, will constitute a sufficient guarantee that the instructional work will be faithfully performed.

In conclusion, we call the attention of those who wish to enter the school, to the calendar, course of study, regulations, and extracts from the report of the Principal, hereto appended.

CALENDAR—1875-6.

FIRST TERM.

Opens Tuesday, June 15th, and closes October 28th.
Fall vacation, from October 29th to November 8th, inclusive.

SECOND TERM.

Opens Tuesday, November 9th, 1875, and closes March 31st, 1876.
Holiday vacation, from December 23d to January 4th, inclusive.

PROGRAMME FOR CLOSING WEEK.

Final examination, oral, Monday, Tuesday, and Wednesday.
Address before literary societies, Wednesday evening.
Graduating exercises, Thursday, 2 o'clock P. M.
Alumni Association, literary exercises, Thursday evening.

CONDITIONS OF ADMISSION.

For admission to the Junior Class, the following qualifications are requisite:

1. *Age.*—If ladies, sixteen; if gentlemen, seventeen years.
2. *Certificates.*—A valid Certificate, State or County, of any grade.
3. *Examinations.*—A limited number, for the present, may be admitted on examination. They must present certificates of good moral character, and pass an examination such as would be required to obtain a Third Grade Certificate.

All pupils are examined monthly, and if they show either incapacity or unwillingness to do the required work, are assigned to lower classes, or excused from attendance.

For admission to the Senior Class, pupils must present a valid Certificate, and pass an examination upon the studies in the Junior year.

None are admitted to the Senior Class under seventeen years of age.

Pupils may be admitted to the Junior Class at any time during the year, but all applicants for admission to the Senior Class should present themselves at the beginning of the year, *as none are graduated, except in the Past-Graduate Course, who have not been one year in attendance in the school.* This is necessary in order to receive the necessary instruction in Methods of Teaching.

Applicants for admission are required to make and sign the following declaration: "I hereby declare that my purpose in entering the School is to fit myself for teaching, and that I intend to teach in the Public Schools of California."

Those who are unable to pass the preliminary examination for admission to the Normal School, can enter the Preparatory Class, until qualified. In this class a tuition fee is required.

COURSE OF INSTRUCTION.

JUNIOR CLASS.

First Term—June 15th to October 28th.

Orthography, Reading, Penmanship, Grammar, Word Analysis, Geography, Arithmetic, El. Botany.

Second Term—November 9th to March 31st.

Grammar and Composition, El. Algebra, Physiology, Phys. Geography, El. Nat. Philosophy, History, and Drawing.

SENIOR CLASS.

First Term.

Nat. Philosophy, Natural History (Zoölogy), Rhetoric, Chemistry, and Geometry.

Second Term.

Eng. Literature, Nat. History, Mental Philosophy, Perspective Drawing, and a general review of the elementary studies.

The Junior Class will receive instructions in methods of teaching during the second term; the Senior Class, throughout the year.

Vocal Music, Calisthenics, School Law, and Science of Government, will receive attention during the year, as opportunity offers.

EXPENSES, ETC.

Tuition is free. Boarding, in pleasant private families, can be had at from twenty to twenty-five dollars per month. All necessary stationery is furnished, and the pupils have free access to a large and well selected reference library.

Unless pupils come attended by their parents or guardians, they will be expected to apply to the Principal or Preceptress, and be assigned to boarding places; and they will be permitted to board only in families approved by the Faculty.

DIPLOMAS.

Diplomas will be issued by the Board of Trustees to those who satisfactorily complete the course of study and training prescribed. The State Board of Examination grants first grade State certificates upon the diplomas.

No certificates are issued by the Normal School, but examinations, by the State questions, may be held when desired by the pupils, for *State Certificates.*

CABINET AND MUSEUM.

The Cabinet is gradually receiving accessions, both by donations and purchases. The Canfield collection of shells has been purchased, and a collection of the birds of California, nearly complete, is in place.

The Trustees desire to return their thanks, in behalf of the school, to the several donors who have sent in mineralogical and other specimens, and to solicit further donations from friends of the school. A little effort on the part of those who have received the advantages of the school, would soon fill our shelves with a full assortment of the valuable and instructive specimens from California. Such donations will be thankfully received and gratefully acknowledged.

APPARATUS.

In its laboratory there is a large and well selected apparatus. To this additions will be made from time to time, and pupils will not only receive instruction from the same, but become familiar with its use.

APPLICATIONS FOR TEACHERS.

There are usually connected with the school, or in correspondence with the Faculty, persons well qualified to teach, and willing to accept suitable situations when offered.

All letters in reference to teachers, etc., will be promptly answered, and if applications are definite enough, teachers can generally be supplied. Applications should state:

1. Male or female teacher required;
2. Grade of certificate required;
3. Beginning and length of term;
4. Wages and price of board;
5. Route of travel, and approximate expense from San Francisco.

GENERAL REMARKS.

It is to be hoped that County Superintendents, and other friends of the Normal School, may be ready to recommend those who are earnestly striving to make themselves good teachers, to enter some of the departments of the school. It may, also, in all kindness, be suggested that none be recommended who are not physically, mentally, and morally fitted for the profession. The fact that a candidate has failed at an examination is, alone, hardly evidence that he should come to the Normal School. While it is our aim, by faithful effort, to fit our pupils for the work of teaching, even here we cannot work miracles, and there are those, of whom no amount of instruction, and no thoroughness of training, can make good teachers.

To those desiring to enter the school, let us say, if you are not prepared to make many sacrifices, to make study your first and only aim while here, to work diligently and faithfully, to be honest in all things, go anywhere else but to a Normal School.

A cordial invitation is extended to the teachers of the State to spend as much of their unemployed time with us as they can thus use pleasantly and profitably. They will be made welcome for a day, a week, a month, or a year.

San Jose, 1875.

REPORT OF PRINCIPAL.

To the Board of Trustees of the State Normal School of California:

Gentlemen: I have the honor to submit to you the following report of the school, for the school year closing March twenty-fifth, eighteen hundred and seventy-five.

The year has been one of continued prosperity to the school. Notwithstanding the many disadvantages under which we have labored, the numbers in attendance have continually increased, and I trust there has been a corresponding advancement in the efficiency of our work. During much of the year, we have had the sound of the saw and the hammer within our walls; yet the thoughtful care of those having charge of the work upon the building, has saved us from any considerable annoyance. The average enrollment for the first month of the year was two hundred and two, and for the entire year, has been two hundred and thirty-nine. During the months of December and February, just previous to the holidays and the March examinations, the enrollment reached two hundred and eighty. The average attendance for the year has been two hundred and thirty-four, or a trifle over ninety-eight per cent of the average number enrolled.

Of the number in attendance, nearly all have been earnest workers, anxious to make themselves good teachers, and ready to use faithfully every advantage offered. These will go out from us to do good work in the schools of the State. A few have mistaken the school, or their fitness for it, and have been dropped from our numbers; six have been dismissed, because the Faculty thought them unfit, by their habits and morals, for the teacher's profession; and a few more than this number, because they lacked either the ability or the studiousness to do the work of the school, have been advised not to return. Following the course indicated by the Board, we have retained in the school only those who give promise of being useful in the work of educating the youth of the State.

A detailed statement of the proceedings of the Faculty in this matter, is at the disposal of the Board.

We present to you a class of forty-five for graduation. It is, we believe, the largest number ever graduated in any one year—all having taken the full course of study and training required. These have all demonstrated ability to teach, in their practice in the training school. While none are as well qualified as we could desire, they have all done as much as can be reasonably expected in two years time. They will certainly engage in the work of teaching with an understanding of what they are to strive for, and will work with considerable intelligence toward the attainment of the end sought.

The time allowed for our course of study is too short. Taking into consideration the large number of subjects upon which instruction must be given, and the qualifications of those who come to us for instruction, it is impossible to secure as high a grade of scholarship as is desirable, and, at the same time, to make them sufficiently familiar with methods of teaching, to enable them to be successful in the highest degree. I, therefore, unhesitatingly recommend that the time for the full course be extended to three years, and that, to meet the great demand for teachers, an elementary course be established, and an elementary diploma granted.

During the year, we have been obliged to instruct four Junior classes. These have, much of the time, numbered forty-five each. The Senior class has numbered about fifty, and of this, but one class could be made.

Our instructional force has been quite too small. While it is as easy to teach forty as one, it is impossible to give to classes of this size the training in expression, and in clearness of thought, so desirable in the teacher. From the very nature of our work, a normal school requires a much larger corps of teachers, in proportion to the number of pupils, than other schools. The principal work must be *training* rather than *teaching.*

The appropriation made by the last Legislature for current expenses in the school, was based upon a prospective attendance of one hundred and fifty; that being about the maximum attendance last year. As the number has very nearly doubled, this has been quite inadequate to meet the present pressing needs of the school. A wise policy would indicate that liberal appropriations should be made, that we may exercise all the influence for good possible, upon the schools of the State.

I do not see how the work of instruction and training can be carried on efficiently for the coming year, without at least two more teachers in the Normal School proper.

The Preparatory Class has been kept up during the year, and has been nearly or quite self-sustaining. Experience has demonstrated its necessity, and it should be continued and enlarged. I therefore recommend the election of a regular teacher in this department.

The Training School, also nearly self-sustaining, has been well patronized, and is of incalculable benefit to the pupils in the Normal School. The advancement made by the pupils in this department abundantly demonstrates the advantages of a regular and systematic course of instruction and training.

A considerable number of teachers have availed themselves of the invitation extended, to spend some time with us, for observation and instruction. We have tried to make them welcome, and I think they have been more than satisfied with the benefits they have received.

To the Faculty, who have worked so faithfully and earnestly (and how faithfully and earnestly no one can know better than the Principal), and to the Board of Trustees, for their intelligent and liberal support of the school, to the full extent of the means they have possessed, I would here express my sincere thanks.

Hoping that the coming year may be even more prosperous than that which has just closed, I remain, very respectfully,

Your obedient servant,

CHAS. H. ALLEN,
Principal.

GRADUATES.

First Class.................................*May*, 1863.

Comstock, Bertha	Fink, Augusta P.
Hart, Nellie	Mails, Louisa

Total, 4.

Second Class..............................*May*, 1864.

Ashbrook, M. V.	Jewett, Lizzie B.
Baldwin, Ellen S.	Krauth, Augusta M.
Beverly, Victoria	Kimball, Adrianna L.
Carey, Susie D. L.	Norton, Mary J.
Cummings, Clara A.	Smith, Jennie
Clayton, Julia	Scott, Minnie
Day, Jennie O.	Solomon, Eva
Grant, Ellen G.	Wade, Margaret
Goldsmith, Mary	Williams, Mary E.
Jewett, Annie S.	

Total, 19.

Third Class..........................*December*, 1864.

Allyne, Lucinda	Girvin, Minnie
Broadbent, Elijah	Kennedy, Annie E.
Bradshaw, William R.	McBride, Henry E.
Davis, Sadie	Sawyer, Philena
Field, Carrie P.	

Total, 9.

Fourth Class..............................*June*, 1865.

Campbell, Cornelia E.	Menges, Caroline A.
Cameron, Augusta S.	Mills, Sophronia
Gibbons, Anna	Nichols, F. A. E.
Jordan, Maggie L.	Pershin, George S.
Jourdan, Annie M.	Perkins, Mary
Littlefield, Nellie A.	Soule, Fanny
Morgan, Florence A.	Youngberg, Mary

Total, 14.

Fifth Class..........................*December*, 1865.

Doud, Nettie	Loutit, Alexander J.
Estabrook, Mary H.	Megerle, Louis J.
Frissell, Sarah A.	O'Conner, Maria
Greer, Jennie E.	Pascoe, Mary
Hall, Mary E.	Williams, Sabrina A.
Kennedy, Joseph F.	

Total, 11.

Sixth Class..................................*June*, 1866.

Carswell, Abbie	Moulthrop, Mary S.
Campbell, Amy E.	Olinger, Abner F.
Flint, Almira T.	Piper, Frances B.
Garrison, Gazena A.	Rogers, Arthur
Gummer, Lillie E.	Simon, Frances
Humphrey, Erwin D.	Soule, Maria L.
Holmes, Annie M.	*Stephenson, Charlotte F.
Morgan, Mary J.	Trowbridge, Nelson S.
Morgan, Lizzie A.	White, Elizabeth
Miller, Sarah E.	White, Silas A.
Metcalf, Mary F.	York, Elizabeth

Total, 22.

Seventh Class..................................*June*, 1867.

Ashley, Julia V.	Heydenfeldt, Mary G.
Anderson, Sarah E.	Harvey, Ella M.
Bevans, Maggie E.	Kennedy, James G.
Bigsby, Emma	Lewis, Cloelia M.
Beers, Adriana L.	Locke, Hattie B.
Chase, Carrie M.	Newell, Lizzie A.
Childs, Charles W.	Owens, Nellie M.
Chapman, Mattie E.	O'Brien, Kate
Clayton, Kate J.	Powell, Howell
Clark, May P.	Roberts, Ella A.
Estabrook, Hattie J.	Smith, Flora C.
Featherly, Henrietta	Smith, Grace
Gaddis, Annie D.	Shipley, John C.
Germain, Clara	Wright, Ada E.
Gray, Annie L.	Wooll, Hattie L.
Hart, Mary T.	

Total, 31.

Eighth Class..........................*November*, 1867.

Cocks, Roxa A.	*McNaughton, C. D.
Eames, R.	Perkins, Mary
Howard, Maggie	Savage, Mary E.
Hunt, B. E.	Sears, Marion
Lawless, Martha.	Slater, Henrietta

Total, 10.

Ninth Class..................................*May*, 1868.

Ashbrook, Truman P.	Cope, Lizzie
Batchelder, Ella E.	Crittenden, Lillian
Betancue, Lizzie C.	Day, Frances A.
Bonnell, Lucy	Field, Sarah
Brown, Julia B.	Hall, Anna
Cathcart, Annie	Hall, Sallie L.

*Deceased.

Hammond, Josiah S.	McKean, Lotta
Heney, Julia	*McPherson, Hellen
Jacks, Fannie	Paine, Sumner T.
Joice, Amelia	Palmer, Anna
Jones, Edward W.	Powell, David
La Grange, Anna	Shelley, Troy
Lawrey, Beatrice M.	Smith, John A.
Lawton, Susie S.	Smith, Mary
Lewis, Annie H.	Staples, Elizabeth
Little, Mary	Stokum, Marion
Magoon, William N.	Stone, Mary E.
Maison, Amelia L.	Treadway, Addie
McCollam, Lizzie	Ward, Mary

Total, 38.

Tenth Class..1869.

Bell, Mary	Northcutt, Cara A.
Bryant, Annie	Parker, Olive G.
Buckman, Samuel F.	Pepper, Adella
Campbell, Ruth G.	Pratt, Mary E.
Curragh, John M.	Robinet, Nellie
Gould, Marietta J.	Smith, Maggie E.
Grogan, Annie E.	Solomon, Esther
Hayburn, Annie	Stegman, Mattie H.
Jones, Absalom T.	Stowe, Augusta M.
Lacey, Louisa	Thomas, Mary A.
Lindberg, Emily U.	Watson, Maggie H.
*Mackie, Clara A.	Weed, Alice
Mann, Jennie S.	Whitmore, Ella L.
McColgan, Kate F.	Wright, Mary A.
Millett, Clara B.	

Total, 29.

Eleventh Class......................................1870.

Adams, Clara	Haas, Annie
Allison, Arminta E.	Hardeman, Deborah W.
Bicknell, Bertha A.	Henderson, Mary J.
Boyle, Sarah J.	Howe, Alvin J.
Burrill, Mary A.	Marvin, Adella
Casey, Joanna T.	Mathews, Mary
Carruthers, Leonora	McKean, Annie M.
Carothers, Isabella	Montgomery, Alberta S.
Clark, James E.	Murphy, Isabella M.
Colby, Mary A.	O'Leary, Katie R.
Eastman, Augusta R.	Royce, Ruth
Garland, Abbie A.	Randall, Rosa
Gibson, Annie A.	Stackpole, Georgie A.
Green, Katie	Savage, Nellie A.
Greer, Mary L.	Shuey, Sarah J.
Graffelman, Loleta	Snow, Alice R.

* Deceased.

Sprott, Maggie
Stone, Helen M.
Stincen, Emma E.
Stockton, Annie M.
Sherman, Fannie A.
Tillottson, Henry J.
*Tillottson, Emma
Turner, Cynthia
Wemple, Emmett L.
Wilson, Jessie E.
Withrow, Marie
Wetmore, Edith L.
Yates, Jennie

Total, 45.

Twelfth Class. ....1871.

Bell, Nicholes Jane
Benjamin, Julia I.
Carrau, Celina Rose
Conmy, Ellen Alice
Clark, Hattie G.
Cottle, Mary Annetta
Doyle, Mary Irene
Fletcher, Annie Amelia
Geer, Emily F.
Hardy, George Henry
King, Mary Ella
Moore, Matilda M. E.
Maguire, Louisa
Pelton, Malvina Chase
Plank, Susanna Rebecca
Russell, Ella Louis
Ruddock, John
Sherman, Ella Imogene
Sharp, James Meikle
Sickal, Marcus Theo.
Tyus, Mary Alabama

Total, 21.

Thirteenth Class..................................1872.

Ashurst, Nellie
Beal, Charles R.
Dixon, Bessie
Frisby, Phebe A.
Fisk, Julia A.
Hixon, George C.
Hilton, Emily H.
Kennedy, Thomas H.
Markham, Charles H.
Phelps, Augusta M.
Peckham, Martha J.
Rixon, Chattie K.
Stephens, Virginia P.
Terry, Eulalia A.
Wagenseller, Etta
Wallace, Alma
Wignall, Fannie

Total, 17.

Fourteenth Class................................1873.

Bruch, Louis
Cahill, Josephine
Carroll, Anna
Chipman, Lemuel J.
Foss, William F. F.
Goodcell, Jr., Henry
Harris, Dora B.
Hendrix, Mary
Kratzer, Lella
Kelsoe, Luella
Merritt, Mary
Merritt, Isabel
Murdock, Ella H.
Martin, Julia
Roberts, Lizzie
Snow, Delia R.
Starr, Nellie
Taylor, Olivia L.
Tilton, Etta M.
Withington, Augusta S.

Total, 20.

* Deceased.

Fifteenth Class.....................................1874.

Auld, Cicilia M
Bennett, Minnie E.
Blackstaff, Mary E. Donovan
Bird, Mary
Brooks, E. R.
Carswell, Ella W.
Cory, Lizzie
Crumry, Alice A.
Day, Frances M.
Grigsby, Florence
Guild, Pacific
Hammond, Hulda A.
Hammond, S. Estella
Henn, Carrie M.
Jackson, Ella A.
Jewell, Jerome W.
Johnson, Isabella
Johnson, Samuel E.
Ketcham, Ariadne G.
Keefer, Sallie E.
Kneedler, Susie E.
Martin, Edith J.
Mead, Emmeline
Miller, Charles N.
Miller, Mrs. Amanda
Mumford, Mrs. M. E.
Murdoch, Maria E.
Murphy, Annie L.
O'Rourke, Maggie
Taylor, Mary A.
Wash, William A.
Whiting, Julia M.
Woodward, N. Zoraide

Total, 33.

Sixteenth Class...................................1875.

Barnes, Emmogene A.
Bateman, Henry
Buckley, Emma
Burt, Minnie Clara
Carr, Mary E.
Clark, Charlotte K.
Cole, Marie
Cowie, Anna B.
Davies, Abbie A.
Fagg, Bell
Farmer, Fannie
Farnsworth, Julia
Farnham, Chas. E.
Franklin, Benjamin H.
Gilmor, Harriet N.
Hanscom, Nathan C.
Hauck, Julia L.
Heath, Alice
Henning, David F.
Hollenbeck, Minnie B.
Howard, Millie S.
Intermille, Rosina
Jones, Nellie R.
Leahy, Mary A.
Lewis, Mary
Little, David F.
Martin, Kate
May, Isabel
McDonnell, Mary A.
Morey, Sabia E.
Morgan, Rose E.
Neary, Annie J.
Pascoe, Jr., William
Root, Ellis J.
Sargent, Lizzie P.
Schenck, Emma
Shirley, James W.
Stockton, Adelia A.
Toy, Emma
Turner, Belle J.
Watkins, Florence M.
Wells, Alice M.
Wible, Annie A.
Wible, Julia F.
Wilson, Mary E.
Wilson, William R.

Total, 46.

Whole number of graduates........ ....378.

RULES AND REGULATIONS OF THE BOARD OF CALIFORNIA STATE NORMAL SCHOOL TRUSTEES.

ELECTION OF EXECUTIVE COMMITTEE.

The Board of Normal Trustees shall, at the annual meeting each year, elect, by ballot, three members, to act as the Executive Committee of the Board.

REGULAR MEETINGS.

The Board shall hold its regular annual meeting during the last week of the last term of the school year, and the semi-annual meeting during the last week of the first term.

SPECIAL MEETINGS.

The Secretary shall call a special meeting at the written request of three members; but no meetings shall be called on shorter notice than five days; and no business shall be transacted at such meetings except that which is specified in the call.

QUORUM.

Four members shall constitute a quorum for the transaction of business.

ORDER OF BUSINESS.

The President shall take the chair at the hour appointed for the meeting of the Board; shall call the members to order, and, if a quorum is present, shall cause the minutes of the last meeting to be read. If a quorum be not present within thirty minutes past the regular hour for meeting, the Board shall stand adjourned. The order of business shall be as follows:

1. Reading of the minutes.
2. Communications and petitions.
3. Reports of Executive Committee.
4. Reports of Principal.
5. Reports of Special Committees.
6. Unfinished business.
7. New business.

YEAS AND NAYS.

The President shall, at the request of one member, take the sense of the Board by yeas and nays.

APPOINTMENT OF COMMITTEES.

All special committees shall be appointed by the President, unless otherwise ordered by the Board.

FOUR VOTES REQUIRED.

No measure or proposition shall be valid unless passed by four votes, except motions to adjourn, to postpone to a definite time, to reconsider,

to commit, to lay on the table, the previous question, to amend, or to substitute.

EXCUSE FROM VOTING.

Every member shall give his vote, when a question is put, unless the Board, for special reasons, excuse him, which question shall be decided without debate. A motion to excuse can only be made before the Board divides, or before the call of the yeas and nays is commenced.

WRITTEN RESOLUTIONS.

All resolutions shall be submitted in writing, with the name of the mover; and any motion shall be submitted in writing if the President direct or any member request it.

RECORD OF COMMITTEE OF THE WHOLE.

Propositions made in Committee of the Whole, unless carried, shall not be entered on the journal.

YEAS AND NAYS.

All motions, resolutions, orders, and votes of the Board, requiring the disbursements of money, shall be taken by yeas and nays, and the vote registered.

All elections shall be by ballot when called for by any one member.

CUSHING'S MANUAL.

The Board shall be governed in its deliberations by the rules of Cushing's Manual, except as provided in these rules and regulations.

AMENDMENT OR REPEAL OF RULES.

The rules or regulations may be amended or repealed at any regular meeting of the Board, by an affirmative vote of four members, notice of the proposed amendment having been given in writing at a previous regular meeting.

The Institution for the Deaf and Dumb and the Blind.

1. The Fire.
2. Number of Pupils.
3. Health and Heredity.
4. Schools.
5. Mechanical Department.
6. Financial Matters.
7. Building and Grounds.
8. Terms of Admission.

The Institution for the Deaf and Dumb and the Blind.

On the seventeenth of January of the current year occurred the great misfortune which not only destroyed the beautiful building provided for the education of the deaf and the blind by the liberality of the people of California, but which for a time threatened to break up the institution and scatter its efficient corps of assistants, upon whose zealous coöperation so much depends in the conduct of a school. The evil was averted, however, by the prompt and judicious action of the Board of Directors, backed by their own credit and the credit of generous friends, who came to their assistance. Before the flames were extinguished, and by their light, a consultation of the Board took place, every member being present. The next morning, at nine o'clock, a meeting was held at the office, where it was determined not to wait for the assembling of the Legislature before making provisions for the helpless pupils, but to assume the responsibilities which had thus been providentially laid upon the Board, and to continue a work to which the State is pledged by every consideration of humanity and true economy. Vacation until the fourteenth of April was declared, to substitute the usual Summer recess; every power and authority was conferred upon the Principal to provide for the comfort of the pupils and their speedy dispatch to their homes; advertisements were ordered for buildings suitable for school purposes; and a public investigation was appointed to inquire as to the causes of the fire, and to fix its responsibility, if there had been blame or neglect.

Of course, the most pressing need was the comfort of the pupils and their distribution. On the night of the fire, friends and neighbors, from all directions, came with offers of hospitality and assistance. Rev. D. McClure, of the Military Academy, took all the deaf and dumb girls, with their attendants, to his house, where he kept them for a week, refusing all compensation therefor. Mr. Haste sheltered fifteen little boys. Mr. George D. Dornin took half a dozen. These, together with Messrs. Shattuck, Sackett, Stearns, Ellis, Kelsey, Sill, Mrs. Alexander, Mrs. Marchand, and others, are all entitled to thanks for their unwearied kindness through the week of flood and storms that immediately followed the conflagration. In consequence of interrupted mail and telegraphic facilities it was difficult to communicate with parents, and the sudden rise of streams, and the destruction of bridges throughout the State, made it unsafe to send children to their homes without escort. In this emergency the help of friends was most grateful and timely, and it came in various ways. President Gilman sent fifty dollars to relieve those whose need was sorest. Lazard Freres sent an equal amount. Mrs.

Page, of Oakland, sent ten dollars. As nearly all the clothing of the pupils was burned, the supplies of wearing apparel and material, sent by Davidson & Co., Levi Strauss & Co., W. and J. Steinhart & Co., Kaindler & Co., Mission Woolen Mills, Pioneer Woolen Mills, were very welcome. Especially are thanks due to the Managers of the Central Pacific Railroad, who not only gave free transportation to those pupils whose parents were unable to pay their fare, but Mr. Towne, the General Superintendent, appreciating the emergency, authorized the Conductors on the road to honor certificates issued by myself, thus facilitating the dispatch of the pupils and relieving me of much inconvenience. In the course of ten days nearly all the pupils who had homes had safely reached them, and the remainder, with the teachers, matron, and nurse, were gathered in a furnished house that happened to be vacant, with grounds immediately adjoining the institution property.

On the twentieth of January the Board held a meeting, open to the public, to investigate the causes of the fire. His Excellency Governor Booth was present, and aided, by questions and suggestions, in eliciting the truth. After an all-day's session, during which every employé present in the building at the time of the fire, was examined, under oath, together with half a dozen of the more intelligent pupils, the architect, Mr. John Wright, and others, the following resolution was unanimously adopted:

Resolved, That after full investigation into the circumstances of the fire that has destroyed the main building of the Institution for the Deaf and Dumb and the Blind of the State of California, that the united testimony of the witnesses examined, in the judgment of this Board exonerates the Principal, teachers, and employés of the institution from all blame of carelessness, and shows that their promptness and efficiency did all that could be done under the circumstances for the safety and comfort of the pupils; also, that the testimony shows conclusively that the fire originated in the northeast portion of the building, between the roof and the ceiling of the third-story rooms, and spread thence along the attic, directly under the roof, to the tower in front; and that the exposure from sparks from the kitchen chimney, either lighting and kindling on the shingle roof, or flying through the louvers into the attic, under the strong wind prevailing at the time from the northeast, is fully sufficient to account for the fire.

(Signed:)

J. MORA MOSS,
L. HAMILTON,
Y. L. BARKER,
E. J. CRANE,
D. D. SHATTUCK.

With my full concurrence.

NEWTON BOOTH,
Governor.

Without giving the evidence in detail it may not be amiss to state the facts of the fire as I observed them. Those who have seen a plan of the institution will remember that it consisted of two parallel ranges of buildings sixty feet apart, connected at the ends by one-story school rooms, and in the middle by the dining-room and chapel, of full altitude with the main structure. The ventilation was in the space immediately

beneath the roof peak. The foul air in the rear building, by numerous ducts, was gathered into the garret, crossed under the chapel roof, and joining the ventilation process of the front building found the open air through the louvers in the tower. The kitchen, of one story, was situated back of the main building, and separated from it by a narrow passageway. The chimney was perhaps forty feet removed from the rear wall, and its top was about on a level with the eaves of the main building, so that the ridge of the Gothic roof must have been ten feet higher than the mouth of the chimney. The roof was shingled. A fierce wind from the northeast was blowing directly across the institution, carrying any burning soot that might be wrenched from the chimney upon the shingles, where a crack offering lodgment, the spark would soon be fanned to a blaze by the gale. The time was most favorable for an accident of this kind. It was Sunday afternoon, on which day the pupils dine at four o'clock P. M., the servants and laborers taking their dinner at the same hour. As everybody connected with the institution was inside and on the lower floor, the fire had a full half hour in which to work and to spread without possibility of discovery. Having gained access to the ventilation apparatus, the flames spread with frightful rapidity from one end of the building to the other, so that the whole roof was involved at the moment when (from half a dozen standpoints) the fire or smoke was seen. The Matron, from the rear corridor, saw smoke issuing from the eaves of the front building; at the same time, from the front hall, I saw twenty feet of flame on the ridge of the rear roof. Two employés, with fire extinguishers, went up into the tower, but were driven back by the volume of fire that, following the lines of ventilation, was pouring across the chapel. The laborers, whose quarters were in the third story rear, heard the crackling, which they thought to be raindrops, and came out to see what was the matter. The boys also had, from the grounds where they went after dinner, discovered the fire, and came running after the fire buckets that were stored on the second floor. All this was simultaneous, or within the space of one minute, and in ten minutes all above the first floor was unsafe. The rapid progress of the fire was extraordinary, and was due in a measure to the precautions taken after the earthquake of eighteen hundred and sixty-eight, to guard against danger from a similar source. In the general alarm following the earthquake of that year, the danger from a possible fire was forgotten in the desire to secure safety from the uneasy and restless force that "doth at times so horribly shake our dispositions." Accordingly, all the walls were studded with two by four scantling, in such a manner as to sustain the ceiling joists even if the walls fell down, and thus a series of wooden chimneys was made through which air was supplied to the flames and their spread facilitated. Yet the loss of the institution is directly traceable to its wooden roof—an instance of how very extravagant economy is sometimes. A stone edifice, costing one hundred and fifty thousand dollars, with all its valuable equipment, was destroyed, and the lives of its helpless inmates put in peril, for lack of the comparatively trifling expenditure necessary to cover it with slate. And this leads me to speak of the importance of constructing buildings, intended for the care and protection of unfortunates, in such a manner as to reduce the fire risk to a minimum. I do not recommend elaborate ornamentation—it is generally a source of weakness and danger, but a pure and pleasing style of architecture, which shall combine strength, safety, convenience, and comfort, is possible, and if honestly carried out in construction, is

in the end economical. State buildings represent the dignity and character of the commonwealth. The tent era of San Francisco indicated not only the migratory feeling of her inhabitants, but a belief in the ephemeral nature of her prosperity and resources. The massive structures of stone, brick, and iron now erected for banks, insurance offices, and hotels represent both the growth of civilization and its stability. These edifices witness the thrift and business foresight of individuals; insane asylums, universities, and institutions for the deaf and dumb, and the blind, testify alike to the thrift of the people, and to that broad and underlying sentiment of humanity which marks modern civilization, and which takes cognizance of individual happiness as well as of the economic value of productive energy. An argument for fireproof buildings is derived from the fact that insurance statistics show an increased liability to loss by fire in public institutions, schools, and churches, which leads all responsible underwriters to charge higher rates for risks taken upon this species of property. The reasons for this enhanced rate, as given me by a prominent underwriter of San Francisco, may be briefly stated:

First—The vast area of roof exposed, with towers, steeples, and spires, invite danger from without, and the height and inaccessibility tend to delay the means of putting out a fire. This danger can be got rid of by making roofs and cornices fireproof, according to plans adopted by the Board of Underwriters.

Second—The difficulty of warming distant portions of large buildings leads to the massing of intense heat at or near its initial point, and it is a well settled fact that superheated steam pipes will set wood on fire. This danger may be avoided by the use of a heating apparatus using steam at a low pressure, and laid in ducts of masonry, with free circulation of air.

Third—In disciplinary institutions there is a liability to incendiarism, arising from the wicked and revengeful element, a percentage of which is found in every community. As long as human nature is as it is, we know of no remedy for this source of danger (which exists, however, in prisons rather than schools), but moral means united to watchfulness, and depriving the wickedly disposed of opportunity for mischief.

Fourth—The peculiar nature and helplessness of the inmates, and the large number of them, make it a paramount duty to save life rather than property. The tendency to panics among children and employés is also taken into consideration, paralyzing effort, and interfering with discipline. The duty of saving life cannot give place to any other consideration, but a judiciously arranged fire drill, such as is enforced upon the Pacific Mail steamships, may be introduced to advantage. In the Appendix to this report will be found the fire regulations now in use in this institution.

Fifth—In public buildings, the selfish feeling which would in the case of private property stimulate to great exertion, is supposed to be detrimental to the public interest, each employé looking after his own little accumulations rather than trying to save the State from loss. Our own experience would go to prove that this is not a necessary sequence. It is sufficient to point to the fact, that in the disastrous fire of the seventeenth of January, nearly every officer, including teachers, matron, nurse, and many of the servants, lost everything they possessed in the way of personal effects, and it is a source of pride to remember how in that emergency all selfishness was swallowed up in regard for the general welfare and safety of the pupils.

NUMBER OF PUPILS.

Since the date of the last report, June thirtieth, eighteen hundred and seventy-three, there have been under instruction one hundred and thirteen pupils, classified as follows:

Deaf and Dumb.		
Males	48	
Females	27	
		75
Blind.		
Males	28	
Females	10	
		38
Total, both classes		113

The admissions since same date have been:

Deaf and Dumb.		
Males	13	
Females	11	
		24
Blind.		
Males	9	
Females	6	
		15
Total, both classes		39

There have been discharged since same date:

Deaf and Dumb.		
Males	8	
Females	3	
		11
Blind.		
Males	8	
Females	2	
		10
Total, both classes		21

Remaining in institution at date:

Deaf and Dumb.		
Males	40	
Females	24	
		64
Blind.		
Males	21	
Females	9	
		30
Total, both classes		94

HEALTH AND HEREDITY.

The health record of the pupils for the past two years has been something extraordinary; and while we acknowledge the Providence in it, we are certainly justified in the conclusion that the diet and regimen of the institution are based upon correct principles of hygiene. Since my last report, there has been no death, no epidemic, no fever, and for seventeen months our hospital rooms were not occupied for a single night. As I have said in former communications, this immunity from disease and death cannot be attributed to "luck." No one need be told that Nature vindicates her violated laws by severe, often terrible, punishments. We sin often ignorantly, oftener thoughtlessly, sometimes willfully, but Nature, more inexorable than human tribunals, demands the penalty. We pay our first violations sometimes by infinitesimal fines—a slight headache, a temporary loss of appetite, an inexplicable feeling of lassitude, or a sleepless night; these gentle admonitions unheeded, there come sharper twinges, more serious complications, till finally the hectic flush of the consumptive, or the parched and swollen tongue of the typhoid, tells of violations past forgiveness and beyond remedy. In an institution of this kind we have to watch not only the sanitary conditions of the house and the thoughtless tendencies of young people to carelessness and exposure, but in many cases we have the effects of the sins of the fathers to fight against. While the laws which govern heredity, both psychological and physical, are undetermined, sufficient facts have been collated to prove the existence of such laws. That "points" and qualities may, by judicious selection, be transmitted, is recognized by every stock breeder. That weak lungs, impaired nervous and cerebral organizations, gout, and morbific tendencies generally, are propagated by injudicious marriages, few physicians would care to deny in the face of daily experience. How parental vice, alcoholism, dissipation, and excess entail their punishment upon innocent offspring, is now coming to be one of the great questions of social science.

It is a sad reflection that, with all our progress in the arts and refinements of civilization, with all the advance in medical science, with the excellent judgment and success attending the improvement of plants and lower species, no adequate remedies have been suggested for checking the steady ratio of abnormalism. Side by side with our civilization walks this broken specter of maimed and incomplete life, laying its heavy burden of taxation upon the commonwealth; but, still worse, depriving the world of so much productive force and diminishing the sum of human happiness. The warm heart of humanity responds quickly to the appeal for amelioration and cure, where cure is possible. Side by side with capitols, universities, and schools, rise asylums for the insane and the sick, institutions for the deaf, the blind, and the idiot. The generous manner in which appropriations are made for eleemosynary purposes seems to argue a halfway confession that somehow society is responsible for its defectives. Is it so? Have preventive agencies within the legitimate reach of civil government been neglected? Have authorities done all that in them lay to let in sunlight and air to the pest holes of the cities? Have laws for the government of tenement houses been framed and executed restraining the greed of the landlord when the tenant, through ignorance, poverty, or indifference, has failed to protect himself? Has adequate provision been made for cheap or free water for baths and proper sewerage? Have statutes for the prompt removal of filth and garbage been enforced? In short, has a broad and effective system of sanitary regulations been devised and executed? Beyond this, is there the proper education among the masses in those principles of health and heredity which are applied in the rearing of horses and cattle? Do men and women enter into the holiest of relations with the same judgment that they exercise in the pairing of birds? Is passion subjected to the higher law of reason? Do parents educate their children in sentiments and habits worthy of the high and responsible duties they are to assume?

Or, on the other hand, is abnormalism a necessary and constant factor in the problem of human society? Like the poor, have we the insane, the deaf, the blind, the idiot, ever with us, by divine appointment? Are there in the race certain abnormal germs which civilization stimulates and fructifies into active life? Such a conclusion is inconsistent with man's dignity and destiny. Health and soundness are normal conditions of the race. Whatever may have been the genesis of man, whether by "special creation," by "evolution," by "survival of the fittest," or by any other method, the type is established, and nature opposes and seeks to remedy any departure from it. Her resources to this end are twofold, namely: to throw off any abnormality after a generation or two, or, failing in this, to cut off the line. Deaf mutes intermarry, but seldom transmit their infirmity. With few exceptions, their children can hear. The sexdigital Colburn family cleared itself of the supernumerary finger and toe in about four generations. Monstrosities will generally be found sterile, or they propagate weaklings that die young. Adrien Jeftichjew, the "dog man," not long ago exhibited in Paris, married and had two children, but they both died in infancy. Edward Lambert, whose whole person, except the face, palms, and soles, was covered with horny plate—like excrescences—had six children, all inheriting the father's peculiarity. Five died young, but the sixth survived to perpetuate the defect, which lasted through five generations—a remarkable example of abnormal persistence. Albinism, cleft palate, and hare-lip, are generally sporadic, although sometimes traceable to "reversion." Families with the hereditary taint of consumption rapidly become extinct, at least in the line of members who inherit the tendency.

Nevertheless, the general average of the race is improving; of which the increase in longevity is a gratifying evidence. The average of life has so risen within a few hundred years that life insurance has been exceedingly profitable, while annuity companies have been brought to the verge of bankruptcy. In sixteen hundred and ninety-four, the English Ministry, to relieve its financial necessities, negotiated a loan, to be repaid in annuities, and made a handsome thing out of it. William Pitt, less than a century later, tried the same remedy with disastrous results. In Geneva, where accurate statistics have been kept for three centuries, the tables show that from fifteen hundred and sixty to sixteen hundred the average lifetime of the citizens was twenty-one years and two months; in the following century, twenty-five years and nine months; in the next century, thirty-two years and nine months; and in the year eighteen hundred and thirty-three, forty years and five months. In France, in spite of the many wars in which the nation has been engaged, human life has been gaining at the rate of two months a year for the last century. In sixteen hundred and ninety, the death-rate in England was one in thirty-three; in seventeen hundred and eighty it was one in forty, and now it is one in sixty. Moreover, elaborate tables of comparison, made by Dr. Thompson, of the British army, between New Zealanders, a favorable type of barbarians, and Anglo-Saxons, prove conclusively that in stature, weight, girth of chest, and muscular power, the heir of civilization is far in advance of the child of nature.

With these evidences of human progress, it is not unreasonable to hope that the ratio of abnormalism will give way before the ameliorating influences of better living, of wiser methods of medical practice, and especially of a profounder acquaintance with and observance of physiological laws, in the investigation of which so many earnest and active minds are now engaged. By reason of the destruction of all my books and papers, in the late fire, I am not prepared to assert that the ratio of deafness and blindness is decreasing; yet I believe it is, and hope in a future report to sustain my belief by authorities.

SCHOOLS.

The condition of the schools has never been more satisfactory than now. On the part of the teachers, without exception, there is and has been a spirit of zeal and devotion to the interests of the pupils and the institution that is very gratifying, while skill in teaching is coming with experience and larger acquaintance with the peculiarities of the minds to be instructed. The pupils study diligently, are generally amenable to discipline, and are daily developing the better traits of manhood and womanhood. For the last two years the discipline of the institution has been maintained almost entirely by the stimulus of the Roll of Honor. Every month a record is made up from the teachers' and Supervisors' reports, and the names of those pupils who have not been tardy at meals or any exercises of the school; whose deportment has been unexceptionable, and who have reached ninety in scholarship (one hundred being maximum), are posted in the front hall, upon a lithographed roll. At the same time the pupil is given a card, which he can send home. At the end of the year a lithographed Roll of Honor is given, which states the number of months the pupil has been upon the school roll.

The long indulged hope of advantage to our pupils by proximity to

the University has at last been realized. In the Autumn of eighteen hundred and seventy-three, two deaf mutes, Theophilus D'Estrella and Charles Y. Smith, entered the Freshman Class; the former, a congenital mute, taking the regular course; the latter, who lost his hearing at five years of age, taking a course in chemistry and physics, with a view to professional life as a metallurgist. Having finished a two years course of laboratory instruction and practice at the University, and a subsequent special course in metallurgy, to the perfect satisfaction of his teachers, Mr. Smith has just gone to Virginia City, seeking that employment which his talents and attainments cannot fail to secure. Mr. D'Estrella is just entering upon the Junior year, grappling the difficulties to which his deafness subject him, with his characteristic and indomitable pluck, and, without doubt, will yet win the first regular diploma ever taken by a congenital mute in competition with fellow students who can hear and speak. We are now preparing a class of three mutes for the same course on a somewhat different plan. The mathematical studies have been the stumbling block in the University course. We purpose to carry this class through the entire course of mathematics before entering the University, so that when they do enter, the pupils will have in that difficult department only the comparatively light labor of review. We also hope by that time to be in a position to employ a regular Professor, who shall accompany the students and translate the University lectures in signs, and "coach" them in the evening for their daily recitations. In this way, it is hoped to produce such results in the higher deaf mute education as have never yet been obtained.

MECHANICAL DEPARTMENT.

It is a matter of profound regret that the utilization of the shop building for school and dormitory purposes, in connection with the additional structure erected by the Board, has necessitated a suspension of the mechanical department of the institution. This is one of the calamities involved in the late fire. It has been the policy of the management to educate all the pupils in school and craft at the same time, so that when they graduated the way was opened for immediate self-support. It seems most unfortunate that at a time when the problem "What shall we do with our boys?" is agitating the public mind, and the institution was daily offering a practical solution of the difficulty, we should suddenly be compelled to suspend so important a feature of our work. The only satisfaction is in the prospect we have of being able to organize hereafter a series of fine and well-equipped shops, when the Legislature shall have made other provisions for the more pressing needs of the institution. The present building has been put up with special reference to its ultimate use in this way. The frame is very strong, and the walls and partitions are sheeted diagonally throughout with Oregon pine, while its arrangement of rooms, water, and gas supply offer facilities not only for the reëstablishment of our former trades, but also for the introduction of such new and favorable industries as the labor market may suggest.

FINANCIAL MATTERS.

I am glad to say that the appropriation made by the last Legislature for the support of the institution has proved sufficient for its ordinary needs. The actual current expenses for the two years ending June

thirtieth, eighteen hundred and seventy-five, have been, as per dissections, sixty-eight thousand four hundred and thirty-eight dollars and eleven cents, to which must be added certain office expenditures, amounting to two thousand eight hundred and eighty-one dollars and forty cents, itemized as follows:

Carriage hire for Directors	$96 00
Collection charges	68 75
Interest upon advances	1,592 65
Office printing and stationery	52 00
Salary of Secretary and Treasurer	1,000 00
	$2,809 40

Adding this sum to the amount of current expenses, and we have a total of seventy-one thousand two hundred and forty-seven dollars and fifty-one cents. Deducting from this gross amount the sum of five thousand and ninety dollars and fifty-eight cents, cash paid into the treasury as receipts from Nevada pupils, clothing, custom work in shops, etc., and we have a balance of sixty-six thousand one hundred and fifty-six dollars and ninety-three cents, as the cost of this institution to the State for two years, or a monthly cost of two thousand seven hundred and fifty-six dollars and fifty-four cents.

While this exhibits the ordinary current expenses of the institution, its extraordinary expenditures amount to thirty thousand six hundred and seventy-five dollars and seventy-one cents, which really represent investments, as the property created thereby is worth its cost. We have, then, as the total receipts and expenditures since July first, eighteen hundred and seventy-three, to June thirtieth, eighteen hundred and seventy-five, placed in the respective funds, as follows:

GENERAL FUND.

Dr.		
In Treasurer's hands, cash or warrants, July 1st, 1873	$2,813 91	
Received from State Treasurer, including warrants due but not payable for want of funds	72,000 00	
Received from Principal, for Nevada pupils, clothing, shops, etc.	5,090 58	
Interest on deposits	103 87	
		$80,008 36
Cr.		
By vouchers paid current expenses for twenty-four months ending June 30th, 1875	$68,438 11	
Cash paid office expenses, as per itemized account	2,809 40	
	$71,247 51	
Cash due General Fund, July 1st, 1875	8,760 85	
		$80,008 36

IMPROVEMENT FUND.

Dr.		
To cash or warrants in Treasurer's hands, July 1st, 1873	$2,143 20	
To cash received, half amount appropriated by Legislature of 1873-4	2,500 00	
		$4,643 20
Cr.		
By cash paid for labor on grounds	$960 00	
By cash paid for advertising	71 75	
By cash paid for material	2,490 95	
By cash paid for topographical map	150 00	
	$3,672 70	
By cash due Improvement Fund	970 50	
		$4,643 20

SHOP FUND.

Dr.		
To cash or warrants in Treasurer's hands, July 1st, 1873		$1,241 65
Cr.		
By loss on shops, but included in current expenses	$356 34	
By balance due Shop Fund, July 1st, 1875	885 31	
		$1,241 65

SPECIAL FUND.

Dr.		
To cash received from various funds of institution	$7,973 00	
To cash received from Union Savings Bank, the payment of which is guaranteed by forty notes of $1,000 each, given as collateral security	19,030 01	$27,003 01
Cr.		
By cash paid California Bridge and Building Company	$14,870 00	
By cash paid for repairing bakery building, tank house, painting, plumbing, etc	2,872 35	
By cash paid for furniture	7,675 10	
By cash paid for school furniture	793 56	
By cash paid for advertising	48 50	
By cash paid for architect's fees	743 50	$27,003 01

For the payment of this indebtedness of twenty-seven thousand and three dollars and one cent, an immediate appropriation should be asked. With ordinary care and economy, no increase in appropriation is needed.

BUILDING AND GROUNDS.

Of course all the improvements made in the stone building have been lost by the fire. The grounds, however, have been improved, especially in the way of tree planting and blind draining. A plan for the front terrace had been adopted just before the fire, and the stone delivered for carrying out the details, but no use has been made of the material. It will, however, be of value to any future building erected. A fine forest of eucalyptus trees, pines, cypress, and varied acacias, has been set out back of the institution, and is doing well. Fifteen or twenty groves have also been planted on the hill and fenced. A new cow-shed, sixty feet long, has been erected and a plank walk laid to the horse cars, a distance of about three fourths of a mile. The garden has supplied the household with the best and freshest of vegetables, the variety and quality of which may be seen by looking over the gardener's monthly reports. The orchard has not come into full bearing yet, but has yielded enough to prove the fine quality of the fruit we may expect in a year or two more.

We are indebted to Governor Stanford, of the Central Pacific Railroad, and to Peter Donahue, Esq., for continued favors in free transportation of pupils who had not the means of paying their fare; to Dr. R. E. Cole, dentist, of Oakland, for many acts of generosity to our children, with no other reward than comes from the satisfaction of kind acts kindly and freely performed; and to the Giant Powder Company

for gratuitously blowing down the walls of the old institution left in a dangerous condition by the late fire.

The following papers have been sent to the institution for the use of the pupils, and thanks are hereby tendered to the proprietors: *Daily Examiner*, San Francisco; *Mexico Independent*, Mexico, New York; *Deaf Mute Advance*, Jacksonville, Illinois; *Kentucky Deaf Mute*, Danville, Kentucky; *Index*, Denver, Colorado; *Monthly Chronicle*, Columbus, Ohio; *Monthly Pelican*, Baton Rouge, Louisiana; *Michigan Mirror*, Flint, Michigan; *Goodson Gazette*, Staunton, Virginia.

TERMS OF ADMISSION.

The California State Institution for the Deaf and Dumb and the Blind is located about four miles north of the City of Oakland. Between San Francisco and Oakland a steam ferry plies almost every hour in the day, and from the latter city a horse railroad is now constructed, which lands passengers within easy walking distance of the institution.

I. The institution offers its benefits to all deaf and dumb or blind persons who are of age suitable for instruction, and who are of sound intellect, and free from vicious habits and contagious or offensive diseases.

II. No charge is made for pupils from this State, except for clothing and traveling expenses.

III. Pupils from other States or Territories are charged three hundred dollars per annum, payable quarterly in advance. No deduction is made from annual charge, on any account, except in cases of prolonged sickness.

IV. The session begins on the fourth Wednesday of August, and closes the second Wednesday of June. Parents are earnestly requested to enter or return their children promptly at the beginning of the term. Only in extreme cases will the pupils be permitted to leave before school closes.

V. Pupils should be provided with comfortable clothing when they enter the institution, and their wardrobe renewed twice a year.

VI. All moneys designed for pupils should be placed in the hands of the Principal, to whom, also, all letters of inquiry, etc., should be addressed.

Parents or guardians of applicants for admission are requested to furnish written answers to the following questions:

1. What is the name of the applicant?
2. When and where was he born?
3. Is his deafness or blindness from birth; or is it from accident or disease? If so, at what age and from what cause did he become so?
4. Is his deafness or blindness total or partial? If the latter, what is the degree of hearing or sight?
5. Have any attempts been made to remove his deafness or blindness; and if so, what are the results?
6. Are there any other cases of deafness, blindness, insanity, or

idiocy in the same family, or among the collateral branches of kindred? If so, how and when produced?

7. Was there any relation between parents or grandparents before marriage?

8. Has the child had the smallpox, scarlet fever, measles, mumps, whooping cough? Has he been vaccinated?

9. What are the names, occupation, residence, and Post Office address of his parents?

10. What are the number and names of their children?

ADDENDA.

SUPPLEMENTARY LIST OF HOLDERS OF STATE CERTIFICATES AND DIPLOMAS.

Educational Diplomas.

Name.	Expires.
Anderson, Geo. P.	October 23, 1881.
Blake, Chas. M.	October 23, 1881.
Childs, Miss Helen	October 23, 1881.
Colby, Mrs. Mary A.	October 23, 1881.
Goucher, G. G.	October 23, 1881.
Heney, Miss Julia A.	October 23, 1881.
McKown, Mrs. M. E.	October 23, 1881.
Miller, Miss Sarah E.	October 23, 1881.
Ruddock, John C.	October 23, 1881.
Saxe, Heman A.	October 23, 1881.
Soule, Fannie L.	October 23, 1881.
Thomas, Miss Mary A.	October 23, 1881.
Weeks, Annie C.	October 23, 1881.

First Grade Certificates.

Name.	Expires.
Allen, Miss Lulu Edna	October 23, 1879.
Belcher, Miss Mary S.	October 23, 1879.
Bell, Jas. Edgar S.	September 22, 1879.
Bernard, Miss Lizzie	October 23, 1879.
Bowman, Levi	September 22, 1879.
Boyden, Edgar A.	October 23, 1879.
Burke, Mary Julia	October 23, 1879.
Burns, Miss Emma	October 23, 1879.
Child, Miss Augusta	October 23, 1879.
Conrad, Francis W.	October 23, 1879.
Devee, Miss Alpha J.	October 23, 1879.
Duncan, Elizabeth	October 23, 1879.
Faull, Hattie G.	October 23, 1879.
Fuller, Frank C.	October 23, 1879.
Funston, Miss Nina Emma	October 23, 1879.
Garvin, Mary Agnes	September 22, 1879.
Grimshaw, Wm. Robinson	October 23, 1879.
Hartson, D. H.	October 23, 1879.
Housh, William H.	October 23, 1879.
Hursh, George W.	October 23, 1879.
Kelly, Miss Maggie A.	October 23, 1879.
Kidd, Miss Grace E.	October 23, 1879.
Kirk, Miss Mattie M.	October 23, 1879.
Luhrs, Miss Amelia	October 23, 1879.
Maguire, Louise	October 23, 1879.
Maloney, Miss Katie	October 23, 1879.
Margan, Miss Jennie	October 23, 1879.
McArthur, A. W.	October 23, 1879.
McKim, Hettie	October 23, 1879.
Orr, A. R.	October 23, 1879.
Pratt, Miss Helen M.	October 23, 1879.
Ross, M. M.	October 23, 1879.
Ryan, Miss Wlunifred M.	October 23, 1879.
Toll, Mrs. Sarah	October 23, 1879.
Tuck, George Henry	October 23, 1879.

First Grade Certificates—Continued.

Name.	Expires.
Wheeler, Alanson	September 22, 1879.
Wilder, Miss Mary L.	October 23, 1879.
Wilder, Susan W.	October 23, 1879.
Wright, Isaac	October 23, 1879.

Second Grade Certificates.

Name.	Expires.
Burritt, Dwight Nathan	September 22, 1879.

Third Grade Certificates.

Name.	Expires.
Shaw, Mrs. Melissa M.	September 22, 1879.

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APPENDIX.

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IX. INSTITUTION FOR THE DEAF AND DUMB, AND THE BLIND—

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